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FOREWORD

This eighth annual report prepared by the Department of State pursuant to section 503 of Public Law 95-426 (the Foreign Relations Authorization Act for fiscal year 1979) is the best compilation in this series of data on international scientific activities of the U.S. Government. We appreciate the effort of the Congressional Research Service of the Library of Congress in providing an insightful analysis of how well the report satisfies the legislative requirements, and we support the findings and recommendations contained in this year's critique, which was prepared by Ms. Genevieve J. Knezo.

There are several changes that the committees would recommend for improving the Title V report in future years. The committees are concerned that the report was submitted several months late, thereby reducing its usefulness for Congressional oversight of these vital programs. Another shortcoming is the unevenness of the descriptive material. Bilateral science and technology agreements with certain countries are highlighted in Chapter 4, while discussions of other agreements (e.g. Brazil, for which the Administration requested State Department funding in fiscal year 1988) are totally omitted. Further, the reader would be greatly aided by judicious cross-referencing between Chapter 4 and the more in-depth, specialized subject chapters that follow.

While the report does provide, albeit unevenly, a wealth of descriptive material, it frequently fails to address the foreign policy implications of science and technology agreements. This shortcoming is apparent in the report's cursory coverage of several topics of obvious relevance to policy-making: a surge of activity in fiscal year 1986 under U.S.-U.S.S.R. bilateral science and technology agreements; the ramifications for foreign science and technology activities of the White House's Committee on International Science, Engineering, and Technology (CISET), whose creation and plans merited coverage in the previous Title V report; the implication for the U.S.-Brazil relationship in computer sciences of Brazil's restriction on importation of computer technology; and the interagency ferment concerning renewal of the U.S.-Japan S&T agreement.

Funding data from this report are particularly valuable in helping to assess the relative roles of the many and varied international cooperative science and technology activities which Federal agencies are pursuing. However, the information on funding of science and technology activities remains inconsistent throughout the report. Comprehensive budgetary information also assists in reviewing overall foreign policy, as opposed to studying a host of unrelated foreign policy-related decisions. We recognize the difficulties in assembling reasonably consistent data from Federal agencies, but encourage continued effort in more complete reporting of the funding data required by Title V.

Funding is only one aspect of decisionmaking, however. The Title V text, which highlights major accomplishments, milestones and other activities throughout the year, is critical to congressional oversight and analysis of the costs and benefits that cannot be measured solely by the number of dollars expended. In this regard, the organization of the text of the report has improved with each edition in this series.

The value of this report to the Congress is, without question, far greater today than when Title V was enacted. Lawmakers foresaw that the increasingly competitive world of science and technology would require important decisions on the part of the U.S. policymakers. As the U.S. strives to maintain leadership in many science and technology areas, complex factors such as loyalty to allies, parity of access in international research efforts, and the role of cooperation in "big science" must be analyzed carefully. This Title V report provides the Congress and the American people with an overview to balance these and other factors.

The views expressed in this report are those of the executive branch and do not necessarily reflect the views of the Committee on Science, Space, and Technology or of the Committee on Foreign Affairs of the House of Representatives. The committees do, however, commend those who contributed to this eighth Title V submission.

DANTE B. FASCELL,
Chairman, Committee on Foreign Affairs.
ROBERT A. ROE,
Chairman, Committee on Science, Space, and Technology.

LETTER OF TRANSMITTAL

THE WHITE HOUSE,
Washington, DC, June 17, 1987.

To the Congress of the United States:

In accordance with Title V of the Foreign Relations Authorization Act for Fiscal Year 1979 (Public Law 95-426), I am transmitting the Administration's eighth annual report of the international scientific and technological activities of U.S. Government agencies during Fiscal Year 1986. This report was prepared by the Department of State with information provided by relevant technical agencies, consistent with the intent of the legislation.

Science has always been an international enterprise. Today, as the rate of scientific discovery accelerates, the international character of science is even more pronounced than in the earlier decades of this century. Scientific progress and technological innovation underpin U.S. economic growth, trade and our high standard of living. Our Nation's global competitiveness in the 21st century will depend on maintaining our comparative advantage in science and technology. If U.S. science and technology (S&T) is to remain the world's best, its participants must have full access to developments and scientific results produced elsewhere. In parallel, most countries see S&T expertise and capability as a key to their economic development and long-term competitiveness. They increasingly seek an S&T relationship with the United States to further their national goals. Accordingly, S&T cooperation is playing an increasingly prominent role in the conduct of our foreign relations and diplomatic initiatives throughout the world.

The Administration's international science and technology policy serves four primary objectives: (1) to strengthen the Nation's scientific and technological enterprise; (2) to enhance commercial relations and establish new trading partnerships; (3) to promote our foreign policy goals and improve our international relations; and (4) to protect and, where possible, enhance our national security. We believe that all of the industrialized countries of the world have a responsibility to apply a portion of their economic and manpower resources to basic research to advance human knowledge and ensure humankind's continued ability to meet the challenges of the future. In international scientific agreements, we are working with our global partners to emphasize and implement the principles of equity and reciprocity of access to research and training facilities, experimental sites, information, and data. As specific agreements are negotiated or renewed, we strive to incorporate specific assurances that intellectual property rights will be protected. Such protection exemplifies the general principle of maintaining an equitable balance of contributions and rewards. Protection of intellectual property is also an indispensable element of an investment climate that fosters the rapid devleopment of useful technologies applying the results of international scientific cooperation.

The Technology Transfer Act of 1986 is an example of how these principles will apply to international cooperative activities carried out in U.S. Federal laboratories. Specific provisions of the Act address such factors as safeguards for intellectual property and incentives to assure equity and reciprocity of access in international research collaboration. To ensure that the international cooperation activity pursued at such centers of excellence is truly a two-way street, the Act permits directors of Federal laboratories to take into consideration whether a foreign government permits U.S. entities to enter into cooperative research and development (R&D) arrangements and licensing agreements with comparable institutions. We will certainly encourage the Federal laboratories to look very closely at this as they proceed.

To fully exploit developments in science and technology from overseas, I issued Executive Order No. 12591 on April 10, directing the Department of State to develop a recruitment policy that encourages scientists and engineers from other Federal agencies, academia, and industry to apply for assignments in U.S. embassies abroad. There is a wealth of qualified candidates whose professional careers bridge the domestic and international dimensions of science and technology. They can well serve the interests of our Nation as we collectively face the new challenges of the 21st century.

The task of formulating policies to harmonize international S&T activities with domestic programs and priorities poses a special challenge, given the decentralized nature of the U.S. R&D system. Recognizing the need for a mechanism to manage our resources in the international arena more effectively, my Science Advisor, in December 1985, established the Committee on International Science, Engineering and Technology (CISET) of the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET). This interagency forum commenced operations in early 1986. It is bringing high-level scientific and technical expertise and responsibility in the government to bear on critical international issues. By ensuring that senior policymakers oversee key international S&T issues and activities, the CISET mechanism is helping to integrate international S&T activities into the framework of domestic R&D policy, consistent with the Administration's policy priorities and budget resources.

The United States formal S&T relationship with Japan dates back to the 1950's and to a large extent still reflects the relative scientific status of the two countries at that time. During 1986, the CISET conducted a coordinated U.S. Government review of that relationship and recommended a policy framework for the next phase of bilateral cooperation under the auspices of our Presidential Science and Technology Agreemeent. CISET's recommendations provided the foundation for negotiations with the Japanese that began in early 1987. We expect those negotiations to result in a more sharply focused program of joint research in areas of high priority and equitable benefits to both countries, with increased access by

U.S. researchers to Japanese science and technology centers of excellence, commensurate with the range of access that that our country has long afforded to Japanese students and researchers.

China and the United States first signed an umbrella agreement on science in 1979. As of the end of Fiscal Year 1986, 27 technical protocols have been implemented covering a wide spectrum of science and technolgy activities. The umbrella agreement was extended for a second 5 years during Premier Zhao Ziyang's visit to Washington in January 1984. These S&T activities have been the cornerstone of our relationship with China, opening the door to beneficial interchanges in may areas outside the S&T arena. Since last year new agreements have been signed in water resources, nature conservation, and transportation. The next meeting of the U.S.-China Joint S&T Commission is scheduled for June 1987 in Beijing. We expect to discuss with the Chinese ways that the umbrella agreement can reflect the maturing of scientific relations between our two countries in the years since 1979.

In September, President Jose Sarney of Brazil and I announced an initiative to establish a joint panel of eminent scientists, engineers, and industrial experts to determine priorities for cooperation in areas of mutual strength and benefit. The panel met in April of 1987 and will meet again this summer. The panel's recommendations will be used to formulate an initial agenda to implement the 1984 U.S.-Brazil S&T agreement. It is in the long-term strategic interest of the United States to strengthen ties that have been traditionally strong with Brazil, but which have suffered setbacks during the era of Brazilian military rule. Brazil is poised to become a major power of the 21st century, and believes that science and technology is key to her economic aspirations. Athough our countries are at quite different stages of industrial development, President Sarney and I share the conviction that strength in science and technology is crucial for sustained prosperity. Cooperation in this area affords an important channel for dialogue with Brazil regarding her responsibilities as a mature player in the global economy.

At my meeting with Soviet General Secretary Gorbachev in Reykjavik, we explored the potential for increased interaction in a number of areas of science and technology. As we proceed with the Soviets, as well as the other Bloc countries, in such cooperative programs, our major objectives are to produce a scientific payoff for the United States, while protecting sensitive technology that would contribute to Soviet military objectives.

Bilateral cooperative agreements are only one facet of our scientific and technological activities in the international arena. To an increasing extent, issues of priority concern on the U.S. domestic scene also have international aspects and, thus, require coordinated attention and cooperation worldwide to achieve their solution.

Five years ago, a disease that has become known as AIDS was first identified in our country. Today, it affects all levels of society. Prevention and control of this devastating disease has become one of our Nation's highest public health priorities. However, AIDS is not a problem for the United States alone. AIDS is worldwide epidemic. Alarm over its spread has spurred a concerted international efforts to understand, control, and cure it. The United States is collaborating in the worldwide AIDS research and information dissemination campaign through direct bilateral activities and active participation in mutilateral organizations.

The Chernobyl accident was an unprecedented international emergency that required urgent, immediate response and spurred international organizations to take action on many fronts. Notable among these was the action of the International Atomic Energy Agency to formulate conventions for notification and assistance. Through the leadership of the United States, there is a better understanding of the incident and improved international cooperation on nuclear energy issues, including safety.

The year just ended saw continued close cooperation with the Soviet Union, the United Kingdom, and France to reduce the threat of nuclear proliferation. Five new signatories acceded to the Nuclear Non-proliferation Treaty during 1986. The United States was active in urging nations to institute and strengthen physical safeguards and urged cooperative programs to reduce the use of enriched uranium fuel in research reactors. In bilateral negotiations with several key countries, significant progress was made toward achieving U.S. non-proliferation objectives to help ensure the security of the world.

Cooperation in space remained an important element of our international S&T activities in Fiscal Year 1986, despite the Challenger accident. At the end of October 1985, NASA launched the Spacelab D–1 mission for the Federal Republic of Germany. That mission marked the first dedicated Spacelab application and technology science mission launched for one of our allies. Participation of a Dutch payload specialist on the Spacelab D–1 mission marked the entry of the Netherlands into the manned space arena. Negotiations with our international partners for the flight hardware phase of space Station continued during this time period.

In issues concerning the environment and natural resources, some problems can be solved through national efforts alone, but there is an increasing awareness of a number of problems that threaten the future well-being of the planet, which demand international cooperation on a regional or even global scale. Examples in the environmental area include transboundary pollution, the global carbon cycle, and Antarctic atmospheric phenomena. The United States is addressing these problems through research programs and policy discussions under the multilateral and bilateral auspices and through specific agreements with our nearest neighbors, Canada and Mexico. In the area of natural resources, the United States is cooperating with other countries through a wide range of multilateral and bilateral programs in addressing a number of important problems including: deforestation, the depletion of the world's genetic resources, and desertification. A related issue is concern over the environmental implications of recombinant DNA technology. A major milestone was achieved with the adoption in July by the Organizaton for Economic Cooperation and Development Council (OECD) of a recommendation on recombinant DNA safety considerations. This recommendation is expected to foster harmonization of the regulatory infrastructures of OECD members and of other countries as well and help avoid barriers to international trade.

Our Nation's scientific and technological excellence is a great national asset that underpins our Nation's future economic prosperity and security. To make optimum use of this national asset, we must make wise and long-term investments at home and, at the same time, fully participate in the world's science and technology enterprise. Through international cooperation in science and technology, we can strengthen our future position in global markets and advance our foreign policy and national security goals.

This Administration is committed to strengthening our international relationships in science and technology to ensure that they advance our Nation's broadest interests as we approach the challenges and new opportunities of the 21st century. We shall continue to work closely with our international partners to generate the new knowledge and to apply the innovative technologies of the future to help solve the problems of mankind and ensure global prosperity and security.

RONALD REAGAN.

THE WHITE HOUSE, *June 17, 1987.*

EXECUTIVE SUMMARY

SCIENCE AND TECHNOLOGY IN AMERICAN FOREIGN POLICY-Chapter 1

Developments in science and technology increasingly raise issues affecting our relations with foreign countries. As President Reagan has pointed out, to maintain our nation's competitiveness in the face of the challenges of the future, the U.S. must remain at the forefront of world advances in science and technology which are profoundly international in character. U.S. participation in international cooperative S&T activities is guided by four primary objectives: (1) to strengthen the nation's scientific and technological enterprise; (2) to promote our foreign policy goals and improve our international relations; (3) to enhance commercial relations and establish new trading partnerships; and (4) throughout, to protect and, where possible, enhance our national security. In 1986, from the spectacular to the subtle, the interaction of S&T with foreign policy was pervasive--in high-technology trade, security cooperation with allies, disease control in developing countries, and the more efficient use of scarce resources.

President Reagan and President Sarney of Brazil inaugurated a new joint initiative underscoring the importance of S&T to economic growth in both countries, despite their very different stages of industrial development. The U.S. began exploring a new framework for S&T activities with Japan emphasizing equity and reciprocity of access, and reflecting the fruits of over three decades of bilateral cooperation: our much newer agreement with the People's Republic of China grew to comprise 27 subprograms. The President and the Canadian Prime Minister endorsed their Special Envoys' report recommending demonstration of clean-coal technology. The U.S. led an effort in the Organization for Economic Cooperation and Development (OECD) for biotechnology guidelines consistent with safety and trade. The Chernobyl disaster resulted in increased cooperation and spurred international organizations to conclude conventions for notification and assistance. Following the Challenger tragedy the Department of State and NASA had to work to re-establish an entire international program dependent upon shuttles to launch foreign satellites and experiments. The worldwide AIDS epidemic posed a challenge to the safety of Americans abroad, to immigration controls, and to cooperative research.

In all these issues and programs the Department of State, along with embassies abroad, the Office of Science and Technology Policy, S&T agencies, and the private sector, responded to and met the challenges and opportunities of S&T in the implementation of American foreign policy in the national interest.

ROLE AND RESOURCES OF THE DEPARTMENT OF STATE IN INTERNATIONAL SCIENCE AND TECHNOLOGY ACTIVITIES-Chapter 2

Through Congressional legislation that gives the Secretary of State primary responsibility for overseeing S&T activities with foreign governments, and that created the Bureau of Oceans and International Environmental and Scientific Affairs (OES), the Department of State assumes a major role in the negotiation and implementation of bilateral and multilateral S&T

agreements. Science and technology officers in the Foreign Service, as well as other Foreign Service Officers concerned with S&T issues, are the foundation for S&T reporting from abroad.

The Foreign Service Institute coordinates a program of courses, seminars, and briefings that educate and update Foreign Service Officers in pertinent S&T issues that affect U.S. foreign policy. The Mid-Level Program of the Foreign Service Institute was converted to a new Professional Development Continuum during FY 1986.

The Department of State, through OES and other Bureaus, supports the science and technology officers in the field by means of newsletters, conferences, and other resources. During FY 1986, 52 officers were serving as full-time science and technology counselors and attaches at American Embassies; 30 additional posts have officers who devote at least 20 percent of their work-year to S&T affairs. The OES budget for FY 1986 included approximately $8.4 million for S&T related activities and personnel.

SCIENCE AND TECHNOLOGY IN MULTILATERAL ORGANIZATIONS-Chapter 3

The U.S. continued to play a significant participatory role in a variety of multilateral organizations dealing with S&T. The Department of State took a critical look at some of these organizations during FY 1986 in light of the fact that several of them have not altered their goals and objectives for many years. The U.S. attempted to stimulate discussions among the members of these organizations on their future role and on methods of focusing their efforts. The Versailles Economic Summit Science and Technology Initiative formally concluded during FY 1986 its mandated tasks of fostering international cooperation in a variety of key areas affecting economic growth and employment.

The U.S. was one of the lead countries in the Organization for Economic Cooperation and Development (OECD) discussions on biotechnology. One area of concentrated effort produced published considerations on recombinant DNA safety and regulation. The U.S. also participated actively in the NATO Science Committee, the U.N. Economic Commission for Europe, the U.N. Commission on the Peaceful Use of Outer Space (COPUOS), the World Meteorological Organization (WMO), and other multilateral organizations during FY 1986.

BILATERAL S&T PROGRAMS-Chapter 4

The U.S. has a variety of bilateral S&T agreements in the forms of umbrella government-to-government agreements and agency-to-agency memoranda of understanding. Several milestones in bilateral S&T cooperation were reached during FY 1986. President Reagan and President Sarney of Brazil agreed to an S&T initiative in late FY 1986. As the U.S.-Japan bilateral S&T agreement marked its 25th anniversary, the U.S., guided by the four primary objectives for international S&T cooperation, began steps to refocus future cooperative activities to better reflect the two countries' current priorities and capacities. Cooperative S&T programs with the People's Republic of China and with India continued to expand.

making them two of the largest such programs. The Chernobyl accident stimulated increased and renewed bilateral S&T cooperation between the U.S. and USSR, particularly in the areas of health and environment. Transboundary pollution in the form of acid rain and the movement of hazardous waste continued to be a major topic of U.S.-Canada relations.

AGRICULTURE IN INTERNATIONAL S&T COOPERATION-Chapter 5

Cooperative S&T activities in the multidisciplinary aspects of agriculture are carried out primarily through the Office of International Cooperation and Development of the U.S. Department of Agriculture (USDA). The USDA and its internal components, such as the Forest Service, the Soil Conservation Service and the Agricultural Research Service, work closely with other U.S. agencies and international multilateral organizations in advancing agricultural exchanges and research. Agricultural cooperation with less developed countries frequently centers on improving technologies that directly affect productivity.

In general, cooperation in agriculture benefits the U.S. through improving import and export markets, more cost-efficient research in areas such as the biologic control of pests, and improvement of the world environment. Cooperation with the People's Republic of China (PRC) led to advances during FY 1986 in the control of the gypsy moth, particularly in the area of breeding disease-resistant tree species. Efforts by U.S. and Yugoslav scientists resulted in a better understanding of the pathogenesis of listeriosis and ways to control this dairy-product related infection. The exchange of indigenous tree species and reforestation studies were major areas of cooperation with the USSR, PRC and Algeria.

CIVIL SPACE PROGRAM-Chapter 6

The Challenger explosion in January, 1986 stands out as a domestic space tragedy that had far-reaching international ramifications. There were significant advances, however, in the area of civil space during FY 1986. The once-in-a-century approach of Comet Halley provided the impetus for international cooperation in gathering and sharing data. Discussions and consultations on the Space Station continued between the U.S. and Canada, Japan, and the European Space Agency (ESA) together with its member governments for international participation in the permanently-manned Space Station. Other areas of continuing cooperation included the space transportation system, the international solar terrestrial physics program, TOPEX/POSEIDON, the search and rescue satellite system, Landsat, and others.

ENERGY-Chapter 7

The National Energy Policy Plan states a goal of ensuring that America has an adequate supply of energy at reasonable cost, and promoting this goal is a primary concern of energy related S&T activities. To this end, the U.S. participates in domestic energy research and development, cooperative international research and exchanges, and multilateral organizations such as the International Energy Agency and the Nuclear Energy Agency.

Considerable activity centered around the International Atomic Energy Agency (IAEA) as a result of the nuclear accident at Chernobyl. At the Special Session of the IAEA General Conference in September, two international agreements were opened for signature--the Convention on Early Notification of Nuclear Accidents, and the Convention on Emergency Assistance. In the aftermath of Chernobyl, these and other nuclear safety issues have become items of major international concern. The Department of Energy continued cooperative efforts with a variety of less developed countries. Important areas of cooperative research, exchanges, and training included the development of renewable and non-renewable energy resources.

ENVIRONMENT, NATURAL RESOURCES, AND POPULATION-Chapter 8

Issues dealing with the environment, natural resources, and population are of international concern because occurrences in these areas within a single geographic region can have a global impact. The Department of State and other government agencies work closely with domestic and international organizations concerned with these issues.

An important milestone in U.S.-Canada relations was reached during FY 1986 on transboundary air pollution. President Reagan and Prime Minister Mulroney endorsed the Report on Acid Rain of the Special Envoys. Among other things, the report recommended initiation of a five-year program in the U.S. for commercial demonstration of clean-coal technologies. The U.S. and Canada also negotiated an agreement on the transboundary movement of hazardous wastes.

The U.S. and Mexico made substantial progress during FY 1986 toward resolving a number of transboundary pollution problems. Discussions continued on issues involving Arizona-Sonora air pollution problems, the problems of sewage effluent from Tijuana reaching San Diego beaches, and the transboundary movement of hazardous wastes. Other international concerns included protection of the ozone layer, biotechnology issues related to the environment, and trade in endangered species. The U.S. continued its support of and participation in the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the U.N. Environment Program, and the Man and the Biosphere Program.

The U.S. policy on international population issues is coordinated through the Department of State's Office of the Coordinator of Population Affairs. The policy emphasizes continued support for voluntary international family planning, the role a market-oriented economy can play in achieving population goals, and prohibition of U.S. support for coercion or abortion in family planning programs.

The Department of the Army and its Corps of Engineers is engaged in cooperative exchanges and activities related to navigation, flood control, and dredged-material management. Projects with the People's Republic of China have yielded measurement and testing data, and other information useful in port and navigation channel maintenance in the U.S., as well as in other aspects of U.S. domestic civil works programs.

HEALTH-Chapter 9

U.S. participation in cooperative international health programs advances domestic health objectives, responds to humanitarian concerns, serves foreign policy and development objectives, and provides U.S. representation in international health fora. A major concern in international health during FY 1986 was the epidemic proportions of Acquired Immune Deficiency Syndrome (AIDS). The Department of Health and Human Services (DHHS) and the Public Health Service (PHS) collaborated in AIDS research and information dissemination through direct bilateral activities and active participation in multilateral organizations. The DHHS continued major international cooperative programs of interest to both developed and developing countries. Important programs included vaccine development and vaccination programs, leprosy (Hansen's Disease) research, control and treatment of diarrheal diseases, and child nutrition.

OCEANS AND POLAR AFFAIRS-Chapter 10

The oceans cover approximately two-thirds of the world's surface area and exert a significant influence on climate, food supply, and other global characteristics. Investigation of polar phenomena and the management of polar resources was an area of many-faceted U.S. activity during FY 1986. Numerous U.S. Government agencies are involved in oceans and polar affairs. The Department of State deals directly with numerous policy issues, while agencies such as the National Oceanic and Atmospheric Administration (NOAA) are engaged in cooperative international research programs.

The framework for international cooperation is provided by organizations such as the International Oceanographic Commission (IOC) and the World Meteorological Organization (WMO). The U.S. continued cooperating in global oceans observations with respect to climate and sea level, the World Climate Research Program, the World Oceans Circulation Experiment, the Tropical Oceans/Global Atmosphere Program, and other programs.

With regard to the living resources of the oceans, the U.S. contributed to cooperative efforts dealing with salmon, tuna and anchovies. Strong support was provided for the IOC program on Global Investigation of Pollution in the Marine Environment.

Exploration of sea-bed minerals and petroleum was another area of interest. Bilateral cooperation in marine research and data exchange was carried out through established bilateral S&T agreements. The Office of Naval Research (ONR) conducted a variety of collaborative marine studies in the basic and applied sciences.

TELECOMMUNICATIONS-Chapter 11

U.S. policy on telecommunications enhances the free flow of information between nations, promotes competition in telecommunications technology, and supports international cooperation in developing global systems. In meeting these objectives, there is an expansion of economic and social benefits derived from information that is made available, the effectiveness and competitiveness of American industry is aided, and national security is enhanced. These benefits are derived through U.S. participation in the World Administrative Conference for Mobile Services, the World Administrative Radio Conference on High Frequency Broadcasting, the Center for Telecommunications Development, and other conferences. The U.S. also continued participating in the Intelsat and PanAmSat satellite telecommunications systems. Bilateral cooperation between the U.S. and Mexico during FY 1986 resulted in approximately 300 day-time only radio stations being permitted to broadcast around the clock, and an additional 2000 stations being granted additional hours of broadcast time in the early evening.

TRANSPORTATION-Chapter 12

The U.S. Department of Transportation (DOT) participates in bilateral cooperative agreements and multilateral organizations in order to promote domestic transportation goals and objectives. DOT has formal or informal agreements with 23 nations for the exchange of information or research, and participates in 24 international organizations. Bilateral activities between DOT and Canada included high-level DOT representation at EXPO '86, and cooperative agreements in the areas of arctic marine transportation, urban mass transportation, highway safety and management, and railway safety. Cooperative projects with the People's Republic of China deal with transportation planning technology, and meeting aviation standards, among other areas. There also are relatively large cooperative programs with the Federal Republic of Germany, the Netherlands and the United Kingdom, and smaller scale cooperative agreements with many other countries.

DEFENSE-Chapter 13

The U.S. and its allies continued to make major advances in basic and applied scientific and technological fields. The national security of the U.S. and its allies is tied to cooperation and collaboration in these areas. Standardization of military operations and of defense-related technologies was improved during FY 1986 with the ratification of fourteen Quadripartite Standardization Agreements with NATO countries. A goal of the NATO science program is to achieve economies of scale by coordinating research, development, production, and logistics support.

Armament cooperation and issues involving defense trade among NATO members are addressed through the NATO Defense Research Group, the Advisory Group for Aerospace Research and Development, the Supreme Headquarters Allied Powers Europe Technical Center, the Technical Cooperation Program, the Foreign Weapons Evaluation Program and other elements of NATO. Armaments cooperation and defense trade also occur between the U.S. and non-NATO nations such as Korea, the PRC, Australia, other countries in South and Southeast Asia, and Latin America. An important component of bilateral defense cooperation is the two-way technology exchange with Japan.

SCIENCE AND TECHNOLOGY FOR DEVELOPMENT-Chapter 14

Science and technology are major components of U.S. assistance to developing countries. The U.S. Agency for International Development coordinates a large, complex and multidisciplinary approach to assisting the development of a number of nations in Asia, Africa, the Caribbean, and Latin America. Agriculture is a major thrust of AID assistance, and significant strides in agricultural self-sufficiency and increased productivity have been made by introducing new technologies to developing countries.

Some of these technologies consist of imaginative and novel approaches to age-old problems. For example, solar energy is being used to heat soil in Egypt for the purpose of eradicating crop-damaging nematodes. Taking advantage of a serendipitous discovery in Malaysia, AID is supporting a breeding experiment that is crossing domesticated cattle with a wild tropical bovine species; the result should be a tropics-tolerant beef animal. There are numerous other examples of practical, applied AID projects throughout the world.

Recognizing health care as a primary need of the population in developing countries, AID supports a variety of health projects. These include assisting in the dissemination of information on hygiene and disease, vaccination programs for endemic diseases, and nutritional supplementation for children.

Personnel support for AID projects comes from the private sector and academia, as well as from its own staff. Other areas of AID activity include population, energy, fishery studies, and biologic diversity.

BASIC SCIENCE AND ENGINEERING-Chapter 15

The National Science Foundation (NSF) supports the international activities of U.S. scientists and engineers to advance the national capability in science and technology. These activities help to further U.S. foreign policy objectives, as well as providing unique access for U.S. scientists and engineers to foreign facilities and large-scale phenomena. In addition to research funding, NSF provides support for exchange visits of scientists and engineers, symposia, conferences, workshops, and other relevant activities. Grants and other funding are provided in the area of the basic sciences, engineering, and mathematics.

NSF also provides international S&T support through formal cooperative agreements with a number of counterpart agencies in other countries. NSF assumes the role as lead or executive agency for some government-to-government S&T agreements. NSF provided over $10 million for international cooperative S&T during FY 1986. Additionally, approximately 20 percent of the 12,000 grants awarded by NSF during FY 1986 had international components that testify to the broad scope of the Foundation's scientific and technical interactions in the global environment.

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Chapter 1 - SCIENCE AND TECHNOLOGY IN AMERICAN FOREIGN POLICY

The scientific and technological developments of the last generation influence nearly every aspect of daily existence in the United States. From the complexity of nuclear power to the sophistication of genetic engineering, science and technology have raised the potential of individuals and this nation to new heights. In the same way that science and technology play a critical role in domestic developments, they raise issues that influence foreign policy decisions and implementation. This report reviews the activities during FY 1986 of the U.S. government in response to the challenges and opportunities of science and new technologies in the conduct of American foreign policy and the advancement of our national goals.

International science and technology activities of the U.S. government support many objectives. Foreign scientists contribute importantly to our own understanding and to global progress. Foreign facilities provide outstanding research opportunities for American scientists. Additionally, many areas of scientific investigation, including climate, oceans, and earthquake research can be carried out only on an international scale. Numerous fields of inquiry, tropical ecology, for example, can be studied only abroad. Not surprisingly, the National Science Foundation indicates that 20 percent of the 12,000 grants it awarded in FY 1986 had an international component. All of these activities contribute generally to U.S. foreign policy by strengthening relationships with foreign governments, agencies and individuals.

To itemize specific cause-effect relationships between S&T and foreign policy frequently is difficult. The influence that S&T exerts may be direct, as in the case of strategic technology or trade in high technology products. Alternatively, the effects of a disease eradication campaign in a developing country, or increased awareness of family planning, are likely to be long-term and impossible to measure on an annual basis. Whether direct or subtle, there is no denying the impact of science and technology on our major foreign policy objectives of enhancing national security, supporting freedom and democracy, and promoting global economic growth.

Science and technology cooperation in support of national security is exemplified by numerous activities involving our partners in defense. Daily interaction with NATO allies works both to develop new technologies and to ensure the interoperability of equipment. S&T ties with Japan have been expressed formally in a FY 1986 agreement for the exchange of military technology, and in Japan's public endorsement of the strategic defense initiative. Scientific cooperation with Spain is a significant aspect of our defense ties with that country.

Enhancing the free flow of information and ideas among nations is the primary foreign policy objective of U.S. telecommunications initiatives that directly support our aim of expanding freedom and democracy globally. Less obvious, but no less important, support for this goal is provided by S&T initiatives that are carried out by the Agency for International Development, the Department of Agriculture, the Department of Energy, the National Institutes of Health, and other agencies in support of increased food production, improved health, and better living conditions for hundreds of millions of people in developing countries. Clearly, these activities also make a key contribution to expanding global economic growth.

Bilateral and multilateral cooperation in energy, environment, oceans, and polar affairs helps to ensure sustainable, long-term growth that makes the most efficient use of renewable and non-renewable resources. Work on S&T-related issues in the Organization for Economic Cooperation and Development continues to support the expansion of trade through harmonization of regulations and improved understanding of measures that promote or impede trade in high technology products that account for a significant percentage of U.S. exports.

Health issues became a major concern in foreign policy as Acquired Immune Deficiency Syndrome (AIDS) was recognized as a worldwide epidemic during FY 1986. The AIDS issue has illustrated the urgency for international cooperation, raised concerns about the safety of Americans abroad, and had an impact on the issuance of visas for foreign nationals who wish to visit the U.S. In addition to the impact on health, AIDS has become an economic and political concern. Our Embassies spent considerable time and effort responding to disinformation activities alleging that AIDS is a result of U.S. research.

There are serious concerns about the transfer and diversion of valuable scientific and technological information and hardware, and the effects that this transfer might have on U.S. national security and foreign policy. Provisions for the protection of intellectual property are becoming common in government-to-government S&T agreements, as well as in implementing agreements made by U.S. agencies.

Highlights of bilateral programs during FY 1986 included agreement by President Reagan and President Sarney of Brazil on an S&T initiative for cooperation between the two countries. As the U.S.-Japan basic sciences agreement entered its 25th year, preparations began for negotiations to give a new focus to activities in the next phase of bilateral cooperation. The U.S.-India bilateral agreement on S&T involved 250 projects with funding from a $100 million capital fund. The program between the U.S. and the People's Republic of China continued to expand with the signing of the 27th protocol making it one of the largest cooperative S&T programs. In March, 1986, President Reagan and Prime Minister Mulroney of Canada endorsed the Report on Acid Rain of the Special Envoys. The report recommended, among other things, a five-year program for the commercial demonstration of clean-coal technology. An agreement on the transboundary movement of hazardous wastes also was negotiated between the U.S. and Canada during FY 1986.

International cooperation in high technology undertakings has in fact become so common place that a setback in a domestic program, such as the tragic explosion of the Space Shuttle Challenger in January 1986, will necessarily have significant international ramifications. In response to the world's continuing and growing need for satellite launching capabilities, commercial and government-subsidized programs for launch vehicles increased substantially in Europe and Asia in 1986. The Department of State and NASA worked actively to secure the earliest possible rescheduling of launch dates for NASA's foreign customers.

In December, 1985 Secretary Shultz said:

> "...the world order has been challenged by a host of developments.... We face new strategic realities, new evidence of the power of ideas, new understanding of economic realities, and a new revolution in technology that will have profound political consequences. Each of these forces has forced a philosophical challenge to established orthodoxy, to conventional wisdom without strategic, political and economic relations among nations."

Nothing illustrates this statement better than the effects of the Chernobyl disaster that occurred in April 1986. The incident resulted in a new awareness of the potential for nuclear accidents, and provided the impetus for more frank discussion and exchange of information. In the aftermath of Chernobyl, there was heightened concern at all levels of government and among the public about the effects of the uncontrolled release of radiation on the environment and human health. Recognition of the international significance and need for information following the Chernobyl disaster has led to renewed activity under both the environmental and health agreements between the U.S. and the USSR in the form of Joint Committee meetings during FY 1986. At the multilateral level, the accident led to rapid agreement in the International Atomic Energy Agency on Conventions on Notification and Emergency Assistance in case of nuclear accidents.

Multilateral programs were scrutinized critically during FY 1986 by the Department of State. Concern was expressed over the fact that some of the multilateral organizations in which the U.S. maintains membership have not revised their goals and objectives for many years. The U.S. was one of the lead countries in the preparation of the Council Recommendation on Recombinant DNA Safety Considerations. by the Organization for Economic Cooperation and Development Ad Hoc Group on Safety and Regulation in Biotechnology.

Support for international S&T is provided by the White House Office of Science and Technology Policy and the President's Science Adviser, by the State Department's Bureau of Oceans and International Environmental and Scientific Affairs, by science and technology officers abroad, and by the international affairs offices of domestic agencies. Close coordination among agencies in Washington is an essential aspect of the effort to ensure that cooperative S&T activities support foreign policy objectives. Abroad, embassy science and technology officers play a key role in negotiating and implementing cooperative agreements, and in reporting on S&T developments of interest to the U.S. government, American industry and academic researchers.

To ensure that the Foreign Service continues to attract and reward an adequate number of qualified science and technology officers, the Department of State took steps during 1986 toward developing improved promotion possibilities for personnel serving in the S&T field. Recognizing that successful efforts in the area require a broad mix of policy and technical expertise, the Department remains committed to providing exchange opportunities that will permit highly qualified scientists and engineers from other agencies, industry, and academia to serve in the Department and embassies.

From the frontiers of tropical medicine and agriculture to the frontiers of space, this report describes the rich and varied contribution of science and technology in support of U.S. national goals, domestic and international. The successes of that effort during the past year provide the basis for its continued expansion as we address the wide range of challenges and opportunities before us.

Chapter 2 - ROLE AND RESOURCES OF THE DEPARTMENT OF STATE IN INTERNATIONAL SCIENCE AND TECHNOLOGY ACTIVITIES

The Department of State and the Foreign Service have an impressive history of supporting international S&T. In 1860, under direction of the Secretary of State, Foreign Service Officers participated in a survey of consanguinity systems in different cultures. The survey questionnaire was devised by Lewis Henry Morgan and sponsored by the Smithsonian Institute under its first director, Joseph Henry. The study appears to be the first international scientific survey ever conducted, and its success and the anthropologically valuable data derived from it would have been impossible without the cooperation and active participation of the Department of State.

The Secretary of State was assigned primary responsibility for the coordination and oversight of all major science or science and technology agreements and activities between the United States and foreign countries and international organizations by Congress through Title V of Public Law 95-426 on October 7, 1978. Under this Congressional mandate, the Department of State views the international S&T activities of the U.S. Government as a fundamental aspect of foreign relations. Thoroughly aware of the importance of international science and technology, the Department of State oversees and supports international S&T activities of U.S. domestic agencies to ensure harmonization with foreign policy goals and objectives.

The Bureau of Oceans and International Environmental and Scientific Affairs (OES) is responsible for assuring that the myriad concerns within the broad category of science and technology are given careful consideration in the formulation of foreign policy. OES carries out its responsibility in close cooperation with the Under Secretary of State for Security Assistance, Science and Technology, and the Special Adviser on Non-Proliferation Policy and Nuclear Energy Affairs.

The OES Bureau also works closely with the White House Office of Science and Technology Policy, the National Security Council, the Office of Management and Budget, the National Science Foundation, and the other relevant Federal agencies involved in coordinating and cooperating in international S&T activities. Consultations with appropriate committees and subcommittees in Congress are carried out on a routine basis.

Together with technical agency personnel, OES officers serve as the U.S. Government representatives to international organizations concerned with S&T matters. The OES staff also represents the Department of State in interagency groups and committees dealing with S&T policy, providing foreign policy guidelines and coordination to the agencies. OES acts as liaison between the agencies and the Department of State by being responsible for Circular 175 Authority to negotiate and conclude agreements between technical agencies and their foreign counterparts.

OES plays the leading role in writing and negotiating new government-to-government bilateral S&T agreements, and in revising expiring agreements for extension. The Bureau cooperates and consults with other offices in the Department of State, and other agencies, in developing overall negotiating guidelines and policies, in representing the U.S. Government in multilateral and bilateral negotiations, and in acting as a contact point and liaison between the Department, industry, and other private sector entities.

Science and Technology Officers serving at many of the U.S. Diplomatic Posts throughout the world advise their Chiefs of Mission on S&T issues, and serve as liaison between the governmental and non-governmental scientific communities in the U.S. and in the host countries. Through their reporting, these officers keep the U.S. Government informed of foreign S&T policies and developments. They often are called upon to participate in S&T negotiations, and several manage cooperative bilateral S&T programs. The S&T Officer is an integral and valued participant in the international S&T activities of the Department of State and the U.S. Government.

S&T Training at the Foreign Service Institute (FSI)

Early and Mid-Career Training

There was a transition during FY 1986 from a five-month Mid-Level Program, which included a number of elements, to the new Professional Development Continuum. The new program disaggregates the former Mid-Level Program and recomposes much of that training into a continuum of training from entry into the Foreign Service to the stage of promotion into the Senior Foreign Service.

Under the former Mid-Level Program, the last session of which ended in December, 1985, issues were covered in plenary sessions in the context of overall foreign policy formulation, and in a series of more specific electives. The principal elective in this series was a two-week course, "Science, Technology, and Foreign Policy", attended by approximately one-fourth of the Mid-Level Program participants. The course was designed to acquaint Foreign Service Officers with the growing impact of S&T on international affairs and U.S. foreign affairs interests, to inform them of government and non-government institutions and interests affecting policy formulation in this field, and to introduce key scientific and technological developments that may affect future U.S. foreign policy decision-making. A second two-week elective course, "Military Aspects of U.S. Foreign Policy", examined political-military affairs from a S&T viewpoint. It included the role of technology in weapons development, strategy and tactics, verification, and technology transfer. In addition, a basic introduction to the scientific and technological components of military affairs was contained in a nine-half day course for students not taking the full course. A similar nine half-day course on "Population, Migration, and Refugees" dealt with problems of population growth, urbanization, and international migration. Finally, another two-week elective entitled "Issues in Arms Control and Disarmament" covered problems of verification and the strategic and security implications of new weapons technologies.

A separate one-week "National Security and Arms Control" course for participants not enrolled in the Mid-Level Program was given in November, 1985. Its content basically was the same as the two-week course.

The first portion of the Professional Development Continuum was implemented in late FY 1986. There are plans to include a redeveloped Science, Technology, and Foreign Policy course, the National Security and Arms Control course largely in its present form, and to design a capstone Foreign Policy Management Seminar to complete the series of courses making up the continuum.

Other Professional Development Programs

In the orientation program for new Foreign Service Officers, the increasing impact of S&T in contemporary diplomatic practice is emphasized, and the science reporting function normally is introduced as part of the presentation on economic reporting. Senior officers participating in the ten-month Senior Seminar on National and International Affairs examine the effect of scientific and technological developments on domestic and international economic and military questions. The Foreign Affairs Interdepartmental Seminar also includes units on the scientific and technological aspects of international affairs and U.S. foreign policy-making.

Science Conference Series

The FSI Center for the Study of Foreign Affairs continued sponsorship of a special S&T conference series that brings together public and private sector experts to discuss contemporary international issues. Since the inception of the series in mid-1983, the Center has organized fourteen S&T conferences. Topics in this series during FY-1986 were:

1. Strategic Defense in the 21st Century, October 16, 1985;
2. Controlling Technology Transfers to the USSR, December 10, 1985;
3. The GATT and Intellectual Property, March 25, 1986; and
4. New Techniques in Language Teaching: Focusing on the Computer, September 17 through 18, 1986.

The Center now has published four books based on the discussions that took place during the science conference series. The following titles are on sale to the general public through the U.S. Government Printing Office:

"Science, Technology and Foreign Affairs: Climate, Scientific Dialogue and Health,"

"Science, Technology and Foreign Affairs: Global Environment, Communications and Agriculture,"

"Robotics and Foreign Affairs," and

"Strategic Defense and the 21st Century."

In addition, the Center has produced a video tape of its symposium entitled "How Can Science and Technology Help Africa Feed Itself?" The tape has been distributed to U.S. missions in Africa. Currently, the Center is planning a conference tentatively entitled "Acid Rain: Its Impact on Foreign Relations."

Regional Resource Officer Training

The FSI annually arranges a course for two to four Foreign Service Officers who will assume significant minerals resources reporting responsibilities. The course, given in cooperation with the Department of the Interior, involves consultations with USGS and the Bureau of Mines at Washington and one week of training at regional offices of the Department of the Interior.

Energy Training

Through DOE, FSI annually arranges a one-week course on petroleum matters including supply, physical limits, and petroleum engineering for Foreign Service Officers who will assume petroleum reporting responsibilities.

Officers also are encouraged to enroll in the DOE course on The Nuclear Fuel Cycle and Technical Aspects of Nuclear Weapons Proliferation. Science and Technology Officers have made frequent use of this opportunity to inform themselves before proceeding to post.

S&T Components in Other FSI Courses

Other FSI courses include substantial discussions of S&T issues. The 26-week Foreign Service Economics and Commercial Studies Program includes units on quantitative analysis and computer applications to economics. When S&T issues are important to bilateral and regional affairs, they are considered in the FSI Area Studies courses.

S&T Conferences

The Office of Naval Research in London (ONRL) sponsored a conference in January, 1986 to acquaint Embassy S&T Officers in Western Europe and the Middle East with ONRL activities. Nine Science and Technology Officers attended the three day conference that consisted of lectures, seminars, and discussion sessions. A primary impact of better cooperation and exchange of S&T information between the Embassies and ONRL will be a decrease in expenses incurred through duplicated efforts. It was agreed that there would be an increase in visits to the Embassies of ONRL liason officials and scientists, and more routine exchange of S&T information. ONRL will be added as a routine recipient of S&T reporting documents prepared by Embassy S&T Officers in Western Europe and the Middle East.

S&T Reporting

Factoring S&T reporting into the annual reporting plans for foreign posts continued to receive a high priority during 1986. Special attention was given to ensuring that reporting on foreign S&T developments reaches end-users in industry and academia on a timely basis. The high priority placed on reporting on developments that may improve the competitive position of U.S. industry was highlighted in a joint State-Commerce message to Embassies.

Support

Back-stopping the S&T officers is the primary function of the Office of Science and Technology Support (STS). In addition to providing responses to a wide variety of requests for information, STS provides regular mailings to S&T officers of recent publications received from technical agencies and non-governmental scientific bodies. During the year, the office scheduled briefings with technical agencies and within the Department for 15 to 20 S&T officers on home leave or preparing for new assignments.

Resources

A September, 1986 review indicated that 52 officers are serving full-time in S&T positions in U.S. embassies; forty are directly funded State Department positions. The remainder are funded by technical agencies. In addition, responses to an inquiry carried out early in 1986 showed that at 30 additional posts abroad a part-time officer spent at least 20 percent of a work year dealing with S&T issues. The outstanding reporting by part-time officers at our Embassy in Kuala Lumpur and the Consulate General in Stuttgart demonstrate the effectiveness of the "20 percent club." The total cost for full-and part-time State Department positions is estimated at $5.0 million.

Science Counselors and Attaches

Below is a list of Science Counselors and Attaches as of October 1, 1986:

POST	INCUMBENT	TITLE
Europe		
Ankara	John MacGaffin	Counselor
Belgrade	Thomas Vrebalovich	Attache
Bonn	Edward Malloy	Counselor
Brussels(EC)	Felix Dorough	Counselor
Budapest	James Bodnar	Attache
London	James Devine	Counselor
Madrid	Roy Simpkins	Attache
Moscow	John Zimmerman	Attache
Ottawa	Francis Kinnelly	Counselor
Paris	John Boright	Counselor
Paris (OECD)	Robert Carr	Counselor
Rome	Gerald Whitman	Counselor
Vienna(IAEA)	Carlton Stoiber	Counselor
Warsaw	Joseph Loferski	Attache
Latin America		
Brasilia	James Chamberlin	Counselor
Buenos Aires	William Tilney	Attache
Mexico, D.F.	Reynaldo Morales	Counselor
Near East and Africa		
Cairo	Francis Cunningham	Counselor
New Delhi	Ahmed Meer	Counselor
Pretoria	G. Melese-D'Hospital	Attache
Tel Aviv	Anthony Rock	Attache
Asia and Pacific		
Beijing	Pierre Perrolle[1]	Counselor
Jakarta	David Christensen	Attache
Seoul	Jerome Bosken	Attache
Tokyo	Richard Getzinger	Counselor

1-As of December, 1986

Department of State Domestic S&T Activities

The largest share of the Department of State's domestic Science and Technology activities is carried out and funded by the OES Bureau. Below is a summary of OES personnel positions and the OES budget.

OES Personnel Positions

1986 (Actual)	1987 (Estimate)
141	141

OES Funding (in thousands of dollars)

	1986 (Actual)	1987 (Estimate)
Executive direction and policy formulation	$ 508	$ 511
Conduct of diplomatic relations with foreign countries	6,851	6,859
Administrative and staff activities	1,079	1,080
Bureau Totals	8,435	8,450

Note: In addition to the funding above, a sum of $1,914,000 was appropriated in FY 1986 to fund a one-year extension of the existing United States-Yugoslavia S&T Agreement pending completion of negotiations leading to a new five-year agreement. Similarly, $1,900,000 was appropriated in FY 1987 to fund a further one-year extension of the existing United States-Yugoslavia S&T agreement since negotiations leading to a new five-year agreement have not been completed.

To fund U.S. participation in activities of thirteen international fishery commissions funded through the OES-managed International Fisheries Commissions appropriation, $10,814,000 was appropriated in FY 1986 and $10,800,000 was appropriated for FY 1987.

Chapter 3 - SCIENCE AND TECHNOLOGY IN MULTILATERAL ORGANIZATIONS

U.S. Role in Multilateral Science Institutions

The U.S. continues to participate actively in a number of multilateral science institutions, including the NATO Science Committee, the OECD Committee on Science and Technology Policy (CSTP), the Senior Advisors on Science and Technology of the U.N. Economic Commission for Europe (ECE), and the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS). U.S. contributions during FY 1986 to selected international organizations are shown in Appendix III.

In 1985, the Department of State began a critical examination of the extent to which such international institutions contribute to U.S. foreign policy and/or S&T interests. A number of questions were raised about the work of the institutions, and the fact that some of their mandates have not changed for many years. This effort continued in 1986 with attempts to stimulate discussion within institutions on what their future roles should be and how they best could focus their efforts. Such discussions have advanced considerably in the OECD, mainly because the CSTP is preparing for a ministerial level meeting of the Committee in 1987, and many member states share U.S. interest in looking at fundamental questions in that context.

The Department of State also continued efforts initiated last year to reform and revitalize COPUOS and the ECE Senior Advisers on S&T, two of the more political multilateral bodies. The U.S., in close consultation with Western Allies, is seeking to re-orient these bodies away from extraneous and polemical debate and toward balanced and focused discussion of S&T issues and activities. Some discernible progress was made. For example, the U.S. succeeded in negotiating the addition of two new items, planetary exploration and astronomy, to the agenda of the S&T Subcommittee of COPUOS. Similarly, the U.S. obtained agreement in the ECE to include in the 1987 session of the Senior Advisers a proposal to hold a debate on policies aimed at encouraging innovation by member states having different economic systems. While the changes are important steps in the right direction, much work remains to be done to make these bodies function effectively and responsively to significant interests and concerns.

Economic Summit Science and Technology Initiative

The Economic Summit Science and Technology Initiative formally finished its mandated task in FY 1986. At the 1982 Versailles Economic Summit, leaders of the U.S., Canada, France, the Federal Republic of Germany (FRG), Italy, Japan, and the United Kingdom (U.K.), acknowledged that S&T were fundamental components of international economic relations, and established the "Technology, Growth and Employment (TG&E) Working Group". This group issued reports and recommendations on the relationship between technology and economic growth for each subsequent Economic Summit. The 1982 Summit also started 18 projects to evaluate designated technical areas having high potential for multilateral cooperation. The U.S. led or co-led six projects covering solar system exploration, remote sensing from space, high energy physics, controlled thermonuclear fusion, fast breeder reactor design, and advanced materials and standards. The U.S. participated in six other projects in advanced robotics, biologic sciences, impact of new technologies on mature industries, public acceptance of new technologies, photosynthesis, and aquaculture.

The TG&E Working Group was not meant to be permanent, and by the June, 1986 Economic Summit Meeting had accomplished its original purpose of fostering cooperation in key S&T areas and disbanded. The 18 projects have concluded their activities under the umbrella of the Summit. The projects in fast breeder reactor design and the impact of new technologies on mature industries have disbanded, while others will continue independently or through multilateral agreements. The advanced materials and standards project is one example where multilateral cooperation under the Summit umbrella has proven highly successful. The project has become independent under Memoranda of Understanding (MOUs) and is developing and carrying out an actively expanding program.

Prior to its final meeting in May, 1986, the Economic Summit Panel of Experts on Remote Sensing from Space established three continuing major international groups. These groups, discussed in Chapter VI, are the International Polar-Orbiting Meteorological Satellite Group, the Committee on Earth Observation Satellites, and the International Forum for Earth Observation using Space Station Elements. The Panel sponsored an international conference in September, 1986 at Berlin for experts from Summit countries. They exchanged views with experts and policy makers from developing countries on ways and means to coordinate remote sensing. The Panel also published a report, "The Use of Remote Sensing Technology in Africa for Drought Early Warning and Monitoring"; the report suggested that drought early warning technology might be made available to Africa by establishing remote sensing training centers and data reception facilities.

The TG&E Working Group prepared the "Report on the Environment" at the request of the 1984 London Economic Summit. The report was released for consideration in May, 1985 to international organizations dealing with S&T. These organizations reacted favorably and indicated they were prepared to adopt the priorities identified in the report into their respective programs. The 1985 Bonn Economic Summit asked the Working Group on the Environment to study the improvement and harmonization of techniques for environmental monitoring. They released a report in December, 1985 on techniques and practices for environmental monitoring. The 1986 Tokyo Economic Summit noted the work of the experts on the environment and recognized the need to strengthen environmental cooperation with developing countries.

Organization for Economic Cooperation and Development (OECD)

The Committee for Scientific and Technological Policy (CSTP) of the OECD seeks to reflect through its activities the idea that OECD member states are in the midst of a period of significant technological change. This change has a major effect on industrial structures, provides new opportunities for economic growth and may re-order the competitive standing of industrialized countries. At the urging of the U.S., this was recognized in the 1986 OECD Ministerial Communique, both with regard to the impacts of technological change, and its implications for structural adjustment and trade. Accordingly, the current CSTP program of work continues the effort of the last two years in focusing the activities of the organization on technology and economic growth, and in identifying specific opportunities and areas that can help member countries better utilize technology for their industrial and economic needs.

Economic growth in member countries is strongly dependent upon technological change and the consequent generation of new products and processes. Government policies can often stimulate innovation and entrepreneurial activities, improve structural conditions, and generate market-led economic development.

One prominent issue the Committee has examined in-depth is the field of biotechnology, specifically, safety and regulations. In 1986, the Committee produced a first report on "Recombinant DNA Safety Considerations". The OECD adopted a Council Recommendation in July 1986 covering the use and release into the environment of recombinant DNA organisms.

The contribution of S&T to economic growth is a high priority theme of the CSTP. A Ministerial level meeting of the CSTP, planned for October, 1987, will provide an opportunity to review new policy concerns facing member countries, and will develop new approaches to these needs and challenges. In preparation for this Ministerial meeting, the Secretariat will analyze current and emerging S&T policy issues. The U.S. has attempted to play a major role in the preparatory discussions for the Ministrial meeting, in part because it will coincide approximately with the expiration of the CSTP terms of reference and the need for the CSTP to consider the orientation of its work for the next five to six years. The principal focus of the Ministerial meeting will be on the role of S&T in economic growth. The views of the Ministerial meeting will be factored carefully into how the future program of work of the CSTP is focused. The kinds of questions the U.S. is seeking to have discussed at the Ministerial meeting include: How do new technologies facilitate structural changes in the Western industrialized countries? What changes in national policies would have a significant influence in increasing the contributions of S&T to economic growth? What changes in other areas, such as training and supply of scientific and engineering personnel, would help?

NATO Science Committee

Although small, the science programs are an important, ongoing part of NATO. There are three key elements:

1. The Science Program (established in 1958) for support of advanced research workshops, advanced studies institutes, conferences, collaborative research, individual visits and exchanges, and a number of special programs.

2. The Committee on the Challenge of Modern Society Program (founded in 1969) to address problems affecting the world environment. There are 13 ongoing projects.

3. The Science for Stability Program (originated in 1981 and extended at the beginning of 1986 to continue until 1991), which provides S&T assistance to Greece, Portugal, and Turkey for building up their respective industrial infrastructures.

On the whole, the NATO Science Program is functioning very smoothly. It is unique among intergovernmental science organizations in two ways. The first is that it functions in much the same manner as NSF in the U.S., by emphasizing individual scientists rather than programs. A second facet of the NATO Science Program is that the representatives of member states to Committee sessions invariably are top-flight scientists with well established backgrounds.

The U. S. historically has a strong voice in the NATO Science Program. An American was selected as Deputy Assistant Secretary-General for Scientific Affairs in 1986. Although the U.S. is relatively satisfied with the NATO Science Program, it notes that its basic terms of reference have not changed in more than 25 years, and that a review is long overdue. Such a review was proposed in late 1985, but has not yet begun.

U.N. Economic Commission for Europe (ECE)

The Senior Advisers on Science and Technology (SAST), formed in 1972, is a principal subsidiary body of the ECE, and is designed to promote East-West cooperation and exchange in S&T. The work of SAST has not been of particular relevance or value to the U.S. Other Western countries hold similar views. The U.S. remains interested, nevertheless, in the potential role the Senior Advisers could play as an effective multilateral forum in Europe for cooperation in S&T. The U.S. and Western allies initiated an effort at the 1985 session of SAST to make it more effective, and to restore a sense of balance to its work program. The U.S. made a number of proposals at the session that were developed further in FY 1986 in preparation for the 14th session of the Senior Advisers in September, 1986. Above all, the U.S. strongly urged the Senior Advisers to undertake a critical examination of the work in order to purge the program of projects that have outlived their usefulness, are of only marginal value, or never were useful. The U.S. sought detailed financial and staff information from the Secretariat to facilitate that task. The member states of the European Communities strongly supported the U.S. proposals. In contrast, the European delegations sought to justify maintaining virtually every area of the work program, and to expand it in high technology areas. The Secretariat complied with the request for data, enabling the West to remove or modify several areas of the program that were marginal or one-sided.

The Senior Advisers also debated 12 proposals from member nations for potential new areas of cooperation, but reached agreement on only one, a U.S. proposal for a Senior Advisers debate at their 1987 session on policies aimed at encouraging innovation in member nations with different social and economic systems. In keeping with the overarching view held by the U.S. and other Western countries on the continuing need to rationalize the future work of the Senior Advisers, the U.S. stipulated that the new item would involve no cost to the ECE and would not be maintained in subsequent years without express agreement by the Senior Advisers.

There also were disappointing developments along with the modest progress made in the SAST. One such development was the reluctance of European delegations to agree to a U.S. proposal calling for discussion in SAST of ways to encourage direct contacts among young scientists, an area the Helsinki Final Act cited as deserving the particular attention of the ECE.

U.N. Committee on the Peaceful Uses of Outer Space (COPUOS)

The 53-member COPUOS, its Scientific and Technical Subcommittee, and its Legal Subcommittee all met during FY 1986. COPUOS was established by the U.N. General Assembly in 1958. It was proposed by the U.S. and 19 other nations for promoting international cooperation in the peaceful uses of outer space. COPUOS worked actively and successfully for over 20 years in the exchange of scientific information, and negotiated the four widely accepted U.N. conventions, including the 1967 Outer Space Treaty, that form the basis of international space law. However, the scientific and legal work of the Committee in recent years has deteriorated seriously. Debates have become increasingly political. There has been a tendency to involve the Committee in disarmament and other matters that the U.S. and other Western nations believe are fundamentally at odds with the Committee's mandate and with the consensus procedure that governs its work. At the 39th and 40th sessions of the General Assembly, the U.S., in concert with other Western members, succeeded in checking that decline, at least for the present.

The U.S. jointly sponsored a working paper at the February, 1986 session of the Scientific and Technical Subcommittee with Australia, Belgium, Canada, the FRG, Italy, Japan, Portugal, the Netherlands, Turkey, and the U.K. proposing the addition of two new items to the agenda; the areas were planetary exploration and astronomy. The proposal was intended, in part, to arrest the serious deterioration in the scientific and technical context of COPUOS work. It was one of a number of proposals the West had submitted during the June, 1985 plenary session of COPUOS in an effort to revitalize the work of the U.N. in these areas. The Subcommittee agreed by consensus to add the two new items after extensive talks with other member nations. At the same time, the Subcommittee rejected an Eastern bloc proposal to add new items focused largely on the disarmament position of the USSR.

The annual session of the COPUOS Legal Subcommittee met in March, 1986 and completed work on draft principles relating to civil remote sensing of the earth from space. The Legal Subcommittee began considering these principles in the early 1970s. The debate recently had reached an impasse on such fundamental issues as data dissemination and the responsibility of nations in governing remote sensing activities of private companies. In 1985, Austria submitted a compromise text that resolved those differences in a way that was acceptable to the West. COPUOS endorsed by consensus the Austrian text at its June, 1986 meeting, and forwarded the principles to the 41st session of the General Assembly.

The completion of the principles on remote sensing is the culmination of over 10 years work in COPUOS. It also represents a useful step forward in rejecting (hopefully, once and for all) discussions of radical proposals such as requiring prior consent of a second member nation on projects; a move that could curb civilian activities, especially by the private sector, in this field. The principles are modeled on the policies and practices instituted years ago by the U.S., and encourage the public non-discriminatory availability of data and promote opportunities for international participation in national remote sensing programs.

Despite these relatively useful advances in COPUOS, there are other aspects, including the unwillingness by many members to discuss ways of streamlining COPUOS to make it more efficient and effective, that have remained intractable. The U.S. and other Western nations introduced a working paper on this subject at the June, 1986 session of COPUOS that was greeted with disinterest. The West has succeeded only partially in interesting other members in the process of revitalizing COPUOS and its Subcommittees.

U.N. Educational, Scientific, and Cultural Organization (UNESCO)

The U.S. formally withdrew from UNESCO in January, 1985. Since that time, the U.S. Observer Mission has served to protect American interests at UNESCO and to work with like-minded member nations on reform measures. The Reform Observation Panel of private citizens, named by Secretary Shultz to assess UNESCO and to advance the U.S. interest in reform, worked actively throughout 1985. This year its mandate was extended until March, 1987.

The only UNESCO science programs that the U.S. still formally participates in are the Intergovernmental Oceanographic Commission, the International Council of Scientific Unions, the International Geological Correlation Program, and the Man and the Biosphere Program. In keeping with its commitment to international science cooperation during 1986, the U.S. made voluntary contributions of approximately $1.1 million to UNESCO-related scientific activities.

Multilateral Science and Technology for Development

The U.N. General Assembly established a Financing System for Science and Technology for Development (UNFSSTD) in 1979. After seven years with a general lack of financial backing, the Intergovernmental Committee on Science and Technology for Development again appealed in 1986 to member nations for additional funding support. The U.S. continues to maintain the position that it could consider supporting U.N. sponsored S&T activities for development only if the program was implemented through a general fund, and only with the U.N. limiting its role to connecting the developing country projects with sources of financing and technology.

World Meteorological Organization (WMO)

The U.S. continued participation in the WMO by contributing weather data on a routine basis, participating in working groups and expert panels, publishing world and regional climatic data, and contributing to WMO projects and studies. In FY 1986, the U.S. funded 24.5 percent of the WMO budget. The WMO provides a global network providing prompt weather information for all nations. It also acts as a forum to exchange information, allows international collaboration, trains new meteorologists and scientists, and engages in research and development.

The WMO Executive Council adopted a panel report in 1986 encouraging the maintenance of current environmental satellite capability, and called for broader cost sharing through member contributions toward operation expenses. The WMO Commission for Basic Systems continued work on standardizing data for satellite operations in WMO programs.

Chapter 4 - BILATERAL S&T PROGRAMS

The U.S. has bilateral science and technology (S&T) agreements with 86 nations around the world. More than 20 Federal agencies participate in these programs. On the active end of the scale, 13 Federal agencies have entered into S&T protocols with the People's Republic of China, (PRC), 12 agencies cooperate with Mexico, and 11 agencies conduct bilateral programs with Egypt, France, India and Japan. The Department of State coordinates the various agreements to ensure that they are consistent with U.S. foreign policy objectives.

Cooperative bilateral S&T programs are implemented through government-to-government "umbrella agreements", memoranda of understanding (MOUs) between counterpart agencies and research facilities, and project agreements between research institutions and laboratories. The programs may involve the exchange of scientific and technological information and data, visits and training of scientists and technical experts, sponsorship of workshops and seminars, and cooperative investigative efforts on research projects of mutual interest and benefit.

In managing bilateral S&T programs, the Department of State has direct responsibility for allocating funds in government-to-government programs with India, Israel, Spain, and Yugoslavia. An additional funded program has been proposed with Brazil.

Noteworthy in U.S. bilateral S&T programs during 1986 were the following: The U.S. and Japan celebrated the 25th anniversary in October of the oldest bilateral agreement for basic sciences, and began discussions on a new policy framework for future cooperation. A January survey revealed that the U.S. and India have more than 250 projects underway with funding from a $100 million capital fund. Successful collaboration with Israel also continued under a wide spectrum of agency-to-agency agreements, and through the work of three binational research foundations. Renewed activity took place under seven bilateral S&T agreements with the USSR, and a number of high-level joint committee meetings were held in FY 1986. The U.S.-PRC program of official S&T cooperation, the largest of its kind in the world, continued to expand. Finally, the potential for U.S.-Czechoslovak S&T cooperation was advanced by the signing of an exchange agreement.

This chapter highlights activities with 25 of the countries with which the U.S. has active bilateral S&T programs. Further information on these and other programs may be found in Chapters 5 through 15.

Canada and Western Europe

Canada

Science and technology cooperation with Canada plays an important role in overall relations. Strong links have been established between the Canadian and U.S. S&T communities through professional meetings, exchanges of university researchers, and cross-border associations. Although no formal "umbrella" S&T agreement exists with Canada, these numerous ties contribute strongly to the U.S.-Canada relationship. As an inevitable effect of the proximity of the two neighbors, events in one country have a direct bearing on the well-being of the other.

Substantial progress was achieved during FY 1986 in establishing new cooperative programs to deal with environmental problems common to both countries. President Reagan and Prime Minister Mulroney endorsed the recommendations of their Special Envoys on acid rain during their March meeting at Washington. Former Secretary of Transportation Drew Lewis and former Premier of Ontario William S. Davis recommended a five-year technology demonstration program to deal with the problem of acid rain. The Niagara River Toxic Management Plan will coordinate monitoring and clean-up efforts of both federal governments as well as the state of New York and the province of Ontario. An agreement governing the transborder transport of hazardous wastes also has been signed and will control large-scale movement of such wastes.

Bilateral environmental consultative mechanisms also have been strengthened. EPA Administrator Thomas and Canadian Environment Minister McMillan are meeting on a semi-annual basis to review common concerns. A bilateral advisory and consultative group on transboundary air pollution has been set up to coordinate the actions being taken to implement the Special Envoys' recommendations on acid rain, and closer coordination of the acid rain research programs of both countries has been established.

A large number of U.S. agencies are benefiting from cooperative S&T programs. As their research budgets tighten, many U.S. agencies have sought to conserve funds by sharing research tasks with Canadian counterparts. USGS and other agencies have shown increased interest in cooperative research programs involving regions of Canada, particularly the Arctic. Other USGS cooperative research programs concern the current joint seismic survey of the Great Lakes and joint study of marine sulfide deposits of the Gorda Ridge. The USGS and Canada also cooperated in the International Strategic Minerals Inventory, deep crustal studies, remote sensing, lake eutrophication, and sea-ice studies.

Canada has worked closely with the U.S. in addressing problems such as atmospheric warming, depletion of the ozone layer, and protection of endangered species. Canada has competed with the U.S. in the nuclear field by promoting its unique Candu heavy water technology, but at the same time both Canadian and U.S. policies have supported an effective international safeguards regime based on adherence to the Nuclear Non-Proliferation Treaty. In the aftermath of the Chernobyl accident, Canada gave close support to the efforts to negotiate international conventions on early notification of nuclear accidents, and on provision of assistance to nations that suffer an accident. Canada was among the first signatories to these conventions.

Federal Republic of Germany

The considerable bilateral S&T cooperation between the U.S. and the Federal Republic of Germany (FRG) is testimony to the strong ties between the two nations. The U.S. and FRG work closely in a number of important areas including nuclear non-proliferation, nuclear safety, global ecologic problems, and space. The U.S. and FRG coordinate concerning nuclear supplies and their export to various countries. Increased attention was directed toward nuclear safety and accidents after the Chernobyl disaster. Cooperative global ecologic efforts address ozone depletion and climate modification. Space Station cooperation, now under discussion, would strengthen the U.S.-FRG security relationship, and involve other nations of the Western Alliance in the largest cooperative technological project in history. In addition, there is a considerable exchange of information between the two nations on AIDS research.

Ten U.S. Government agencies conduct active bilateral programs with the FRG. NASA cooperates on space research. USDA conducts research with its German counterpart on the role of air pollution and acid rain in forest damage. NSF conducts joint research on robotics, manufacturing services, and polymer sciences. USGS participated with the FRG in compilation of the International Strategic Minerals Inventory, marine seismic studies, radioactive waste disposal, Antarctic research, and sea-ice studies. DOT cooperates closely with the FRG on rail and highway transportation and socio-economic studies. Other agencies with joint programs include DOC, DOE, DHHS, Department of the Interior, NRC and EPA.

Finland

The U.S. and Finland have concluded eight bilateral S&T agreements in the last five years. They have covered nuclear power and non-proliferation, communications, energy, environmental issues, hazardous wastes, agriculture, health, oceans and fisheries, and space research. These bilateral agreements have expanded contacts with key elements of the Finnish S&T community, and with government and educational leaders.

There also is an umbrella agreement with Finland for S&T cooperation. The NSF sponsors joint workshops and seminars, cooperative research projects, and the exchange of scientists, staff, and information under the umbrella agreement.

Finnish and American scientists have been increasingly exposed to each other's cultures, scientific methods, and shared democratic values. The USIA International Visitor Program has facilitated these beneficial contacts. Reciprocal access to research facilities and sites also has increased, and a new science center modeled after several U.S. science research facilities will soon to be completed near Helsinki.

France

Both the government of France and French industry view S&T issues as central to the nation's economic and security concerns. The French budget reflects the paramount importance of modernization of industry, job creation, and defense.

The U.S. regards S&T cooperation as integral to economic, political, and security relations with France. Some of the more important cooperative interests include the Space Station, breeder reactors, and fusion energy. Discussions about the Strategic Defense Initiative (SDI) and the European EUREKA Project are of continuing common interest.

A large number of U.S. agencies participate directly and indirectly in U.S.-France cooperation. The NSF conducts joint research projects, staff exchanges, and seminars. NOAA carries out cooperative oceanographic projects. NASA works with its French counterparts on the Tiros-N Satellite data collection system.

There is an acute awareness in France that the economic (and thus social, political and security) future depends in part on being technologically competitive. There is an increased emphasis on the role of industry, private innovation, and universities as vehicles of technological progress, and a concomitant decline in dependence on governmental programs. There is a particularly active French interest in the American experience, whether it is university research or industrial research and innovation. An agreement was signed by the Secretary of Commerce and the French Minister of Research and Technology in February, 1986 to establish Franco-American Cooperation in Entrepreneurship and Technology (FACET). Similar to the Israeli Binational Industrial Research and Development (BIRD) Foundation model, but supported by non-government funds, FACET will promote technology and joint ventures between small and medium-sized U.S. and French enterprises.

The Chernobyl accident was an event with major impact on many U.S. interests and efforts in the field of nuclear reactor safety. In France, it rapidly became an issue in which communications in a highly technical area had major political impact. A long-standing and carefully nurtured professional and technical relationship among reactor safety authorities is now the critical element in avoiding political disputes over the safety of nuclear facilities.

Space programs have a substantial degree of identification with national aspirations. The U.S., and to a lesser degree France and other European nations, have this year been stunned by space launcher accidents. The accidents have set back related programs, and introduced new uncertainties in planning for the Space Station and other cooperation. The U.S. has been reasonably successful in maintaining constructive and cooperative relationships in a difficult period.

Italy

The U.S. and Italy have maintained a close relationship in scientific research and technological development since the end of World War II. The U.S. initially provided the major support for cooperative S&T programs by providing scientific equipment, financing, and use of U.S. laboratories by Italian scientists. Italy reciprocated this hospitality by contributing trained manpower, scientific expertise, and inventiveness. Today, the U.S. and Italy cooperate in a more generally balanced partnership reflecting the increase in Italian resources. Support allotted for S&T in Italy has doubled since 1980.

Italy is one of only three countries in Western Europe that have a government-to-government umbrella S&T agreement with the U.S., and 1987 marks the 25th anniversary of the initial formal arrangement. The current agreement was extended for one year during FY 1986 while a new bilateral S&T cooperation agreement, expected to be signed by mid-FY 1987, was negotiated. Nearly all the U.S. Federal technical agencies enjoy mutually beneficial cooperation with Italian counterparts under the umbrella agreement. The biennial review of S&T cooperation was held at Rome in October, 1985. Scientists from the two countries find it easy to identify mutual interests and problems in S&T research and development, and the Italians are as likely as the Americans to take the lead in resolving problems. The Italian Embassy in Washington utilized private sector capital to sponsor a highly-successful meeting on S&T and international relations, cooperation, and competiveness in November, 1986. The invitee list included Italian, U.S., and Italian-American scientists from every scientific discipline and was distinguished by the participation of 14 Nobel laureates.

Spain

A broad program of S&T cooperation between the U.S. and Spain was implemented under the 1976 Treaty of Friendship and Cooperation that provides U.S. Navy and Air Force access to Spanish military facilities. An integral part of this treaty and its 1982 successor agreement was a S&T annex. The annex emphasizes the importance of scientific and technological cooperation between the two countries, and provides for funding of cooperative scientific research in areas relevant to the economic modernization and social well-being of the peoples of the U.S. and Spain.

Congress has appropriated, through FY 1986, $12 million in economic support funds annually to foster scientific, technological, cultural, and educational cooperation under the current agreement. Of these funds, $7 million was transferred each year to the Joint Committee for Scientific and Technological Cooperation, Reduction of this appropriation by 4.3 percent in FY 1986 has limited the prospects for new projects under the agreement that expires in 1988.

Previously-approved cooperative research projects continue to be funded with the major portion of money being devoted to health, agriculture, and marine sciences. No new projects are likely to be funded. As information about this program became more widely disseminated, interest from both American and Spanish researchers increased and large numbers of applications were received, while available funds decreased. The funding rate for the latest set of applications was less than 35 percent. The greater competition, however, does ensure high standards of scientific excellence in the successful proposals.

The available funds for this program provide continuity to long-standing joint Spanish and American cooperative research which in some instances pre-dates the original agreement. For example, cooperation between the Bureau of Reclamation and the Spanish Director General of Hydraulic Works began in 1973 and will continue at least until 1989. These projects are selected on the basis of benefits to U.S. and Spanish natural resources development, and aim to improve application of irrigation water to croplands in order to achieve higher levels of irrigation efficiency for various plants. Long-term continuity has led to sustained success in the agricultural field and in areas such as animal science, animal health, and citrus production. USGS has been able to obtain one of the most complete earthquake catalogs in the world--the Spanish Seismicity Catalog from 880 B.C. to the present. This data base will improve understanding of the earthquake cycle in an area with direct application to the eastern U.S.

One of the most important policy objectives of the U.S. vis-a-vis Spain is to increase the web of ties between the two countries, ties that for historical reasons have not been as strong as with other NATO countries. Each successive round of joint projects strengthens these ties by fostering contacts between the American and Spanish scientific communities. This in turn gives added depth and breadth to the overall political and economic relationship.

Turkey

Turkey's scientific community is concentrated primarily in academic and government research institutions. Its science policy is conducted by Tubitak, a central government board that combines the function of NSF and the National Academy of Sciences (NAS). A number of U.S. technical agencies including USGS, NASA, NRC, USDA, and the Fish and Wildlife Service (FWS) have ongoing cooperative projects with their Turkish counterparts, universities, and private research centers. This cooperation has provided U.S. agencies with useful data on earthquake prediction, and a market for U.S. services and products such as Landsat data and NTIS reports.

Bilateral S&T cooperation with Turkey under the 1983 agreement was initiated in 1986 by a FWS grant to the Environmental Problems Foundation of Turkey. A MOU signed on March 11, 1985 called for increased cooperation in animal science, forestry, plant production and protection, and agricultural economics. Cooperation will occur by using short-term scientific visits, germplasm exchanges, and joint seminars. The overall climate for continuing cooperation in these and other areas is favorable with Turkey providing in-country logistical and scientific support.

United Kingdom

S&T is an important component of the U.S.-U.K. relationship, and cooperative interaction between the two countries on S&T matters remains intense. The scientific communities of both countries have long-standing cooperative relationships at the level of individual scientists, scholarly societies, scientific organizations, and industrial firms. The relationship has been conducted to a large extent in the private sector. Cooperation is so extensive and finely focused, involving many organizations and individuals, that there has been little need for formal agreements between the two governments.

There is, however, a long history of close working relationships between the U.S. and U.K. at the governmental level, including those between semi-governmental bodies dealing with S&T issues (*e.g.*, Smithsonian Institution, NAS) and between government agencies on policy issues. The U.S. and U.K. did enter into three agreements during the FY 1986. One is on nuclear reactor safety cooperation, and two deal with environmental matters. The U.S. and U.K. also worked closely on the aftermath of the Chernobyl disaster, particularly in the International Atomic Energy Agency (IAEA) negotiation of conventions on accident notification and emergency assistance in the event of nuclear accidents. The British also have played a prominent part in joint activities between the U.S. and the European Space Agency.

Environmental problems of transboundary acid deposition, lake acidification, and upper atmosphere ozone layer depletion have been the subject of considerable discussion between in the U.S. and the U.K. Important contributions have been made by British scientists in the evolution of the understanding of the effects of acid rain on fresh water fish and changes in the ozone layer over Antarctica. These scientists also are supportive of the U.S. approach to addressing these issues on a long-term basis in international fora.

It is noteworthy that the U.S.-U.K. MOU on energy concluded in October, 1984, and subsequent agreements--on access to computer databases on energy R&D, to U.S. work on energy conservation, and to research on increased fuel use efficiency--have been put to good use. Major gains in fuel conservation have been achieved in the U.K. through a year-long energy conservation program that has received nationwide publicity.

The British have been involved actively in space technologies. Much of the space activity has taken place in a European rather than bilateral context, but there has been considerable interaction with the U.S. The recent space probes captured widespread attention in the U.K. In particular, the European Space Agency Giotto Space Probe experiments that spectacularly recorded the passage of Halley's Comet on live television, established European space pioneering credentials. The U.S. space probe Voyager's transmission of photographs of Uranus similarly created widespread interest within the university community and among news media.

Yugoslavia, Eastern Europe, and the USSR

The probability of high technology diversion to other Warsaw Pact nations, and to the USSR in particular, is a consideration in the selection and approval of cooperative projects. These concerns naturally limit the scope of U.S.-Eastern Bloc cooperation, and have been taken into account in current bilateral S&T programs.

Yugoslavia

The U.S. has maintained an active program of S&T cooperation with the Federal Socialist Republic of Yugoslavia since the mid-1950s. The initial P.L.-480 program was elevated to a jointly funded inter-governmental S&T cooperation agreement in 1973. The Joint Fund now is supported on the U.S. side through a line item in the budget of the Department of State, currently at $2 million annually, matched equally in dinars from diverse government and non-government sources within the Yugoslav republics and provinces.

The program was initiated to strengthen relations with Yugoslavia's non-aligned post-war government, and has developed into a highly visible and successful joint research and exchange program. Cooperative research projects, workshops, the joint production and analysis of data, and the exchange of experts in most basic and applied sciences, including the agricultural, health and biomedical, environmental and earth sciences, and engineering, have proved mutually beneficial. The program is well regarded in the U.S. and has grown to become Yugoslavia's largest with any country.

Research proposals from U.S. and Yugoslav scientists may be submitted throughout the year and are evaluated competitively through the review systems of 11 U.S. technical agencies. Proposals are judged against criteria of scientific merit, program or mission relevance, and mutual priority, and then are recommended to the U.S.-Yugoslav Joint Board, in numerical ranking, for final approval and funding. Joint Board decisions must be unanimous.

U.S. and Yugoslav contributions to the Joint Fund are made in semi-annual deposits, with interest earnings devoted to Joint Board administration, project development, and additional activities consistent with the objectives of the bilateral S&T agreement. The current five-year agreement, extended in June, 1985 has been renegotiated and will be signed in early 1987.

Czechoslovakia

The potential for U.S.-Czechoslovakia S&T cooperation was significantly advanced by the signing of a bilateral general exchanges agreement in the spring of 1986. This agreement has specific provisions for S&T cooperation that will be arranged on a case-by-case basis through MOU between interested agencies on each side. NSF is exploring a MOU with the Czechoslovak Academy of Sciences. Public health and medicine, environmental problems, and geologic services are among the areas initially being explored for possible cooperation. Other areas await exploratory discussions, and U.S. familiarization with Czechoslovak S&T.

Hungary

U.S.-Hungary S&T cooperation reflects the steady pace in improvement of bilateral relations. Hungarian officials and scientists acknowledge the U.S. as the world leader in S&T. They also acknowledge the role S&T exchanges between the two countries continue to play in the economic development of Hungary.

Several agencies have mutually beneficial programs: NSF has obtained valuable science policy and organization data from bilateral cooperation; USGS has cooperated in geophysical research with Hungarian scientists and is assisting Hungary in assessing the petroleum potential of the Pannonian Basin; and EPA has explored some environmental issues for possible cooperation.

Hungary submitted 18 proposals in June, 1986 suggesting joint research or exchanges involving a broad spectrum of S&T, but with a focus on non-sensitive areas. These areas include basic science and engineering, agriculture, transportation, and pharmaceuticals. The U.S. now awaits detailed project work proposals from the Hungarian side in order to determine which are candidates for final arrangements. Implementing these bilateral programs would expose Hungarian scientists further to U.S. methodology and culture. In return, U.S. scientists may gain access to research, particularly in areas of Hungarian expertise such as biotechnology and radiobiology. This may facilitate the opening of new markets to U.S. manufacturers of scientific support materials.

USSR

There was a surge of activity in FY 1986 under U.S.-USSR bilateral S&T agreements. Renewed activity under seven agreements still in effect, including agriculture, artificial heart research and development, atomic energy, environmental protection, health, housing and other construction, and oceans, was stimulated by President Reagan's speech on exchanges in June, 1984. A number of high-level joint committee meetings, often involving cabinet-level officials, have taken place. Participants in these meetings reviewed past work and approved new cooperative projects. In addition, visits by the U.S. Surgeon General and the Director of NIH in the fall of 1986 have advanced plans for the holding of a joint committee meeting under the bilateral health agreement in the spring of 1987 at Washington. Exploratory talks also were held in September, 1986 at Moscow on a new civilian space cooperation agreement; they produced an ad referendum agreement covering 16 initial projects. The reinvigoration of the various S&T agreements gave new impetus to a variety of mutually beneficial projects.

The agriculture agreement allowed the U.S. side to visit the USSR and study plant quarantine, economics of spring wheat production, economics of winter grain production, economic and technical aspects of cotton production, infectious disease controls in animals, feed manufacturing, reforestation, the agrochemical complex, and genetic materials. An upcoming visit will cover integrated pest management. The Soviet side has sent teams to study economic aspects of dryland grain production and look at contract relations in the entire agrobusiness system. Soviet trips planned for the fall and winter will examine embryo transplants, fertilizer use, dryland grain production, genetics, management methods in agro-industrial enterprises, irrigated land use, reforestation, and computer applications and modeling of farm production.

Nuclear energy cooperation continued on fusion research, the fundamental properties of matter, and fast breeder reactors. A new working group was created to study problems of nuclear reactor safety, and an atomic energy specialists exchange program was initiated.

EPA has 38 cooperative projects with its Soviet counterpart in ten areas. They include prevention of air pollution, prevention of water pollution, prevention of pollution related to agricultural production, enhancement of the urban environment, protection of nature and the organization of preserves, protection of the marine environment from pollution, biologic and genetic effects of environmental pollution, influence of environmental changes of climate, earthquake prediction, and legal and administrative measures for protecting environmental quality.

Health research work is going forward in the areas of cardiovascular disease, artificial heart implants, malignant neoplasma, environmental health, arthritis, influenza, and respiratory diseases. Regular exchanges of health specialists continue.

Projects under the housing agreement include building and construction, industrialized building systems and utilities, building construction in seismic zones, and new towns. The Department of the Army and its Corps of Engineers is negotiating a separate agreement on construction under extreme climatic and geologic conditions. In addition, recruitment is proceeding under the auspices of an agreement for U.S. business participation in a May, 1987 international construction trade show in Moscow. Secretary Pierce led a U.S. business delegation to Moscow in November, 1986 to explore commercial opportunities with the USSR.

All S&T cooperative programs with the USSR take place in accordance with the administration's firm policy that such exchanges be mutually beneficial, balanced, and structured to avoid unwanted technology transfer. Programs conducted on this basis serve American interests and provide a broader scope to the US-Soviet relationship. The benefits of these exchanges include the following:

1. helping American scientists stay abreast of new developments in Soviet S&T;

2. more efficient use of scientific resources through joint research projects in which the complementary contributions reflect each side's scientific strengths;

3. exposing influential Soviet scientists to personal interaction with Americans, thereby helping to modify stereotypes created by Soviet propaganda;

4. normalizing relationships between U.S. and Soviet government agencies;

5. fostering increased cooperation in international fora on matters of mutual concern, such as U.N. environmental programs; and

6. giving the U.S. Embassy in Moscow a far wider range of access to important segments of Soviet society than would otherwise be possible.

The Chernobyl nuclear disaster illustrated the kind of problem that might benefit from better U.S.-Soviet S&T cooperation. Relationships formed with several Soviet ministries and state committees under various bilateral exchange agreements enhanced the ability of the Science Office in Embassy Moscow to communicate effectively with appropriate Soviet officials on behalf of interested U.S. government agencies attempting to convey information and offer assistance.

There were other fruitful S&T activities during the past year. Bilateral consultations on nuclear non-proliferation matters continued. These talks began in 1984 at the instigation of Secretary Shultz and former Foreign Minister Gromyko, and have contributed to increased cooperation in a crucial area of mutual concern. The encounter with Halley's comet by the Soviet Vega satellite carrying U.S. experiments was monitored by a host of U.S. scientists, including a high level delegation from NASA.

Asia

People's Republic of China (PRC)

Policy decisions made by the PRC's Central Committee in late 1978 have resulted in China placing its highest priority on economic development promoting "the four modernizations". Advancing S&T is one of the four and in many ways is seen by the Chinese as the key to the other three aspects of development. Introducing new techniques to modernize China's antiquated industries is one of the priority goals and necessarily precedes a modern economy.

China has identified three principal obstacles to her development: shortages in energy, transportation, and communications. A fourth "bottleneck" that is receiving increased attention is the shortage of educated personnel, both technical and more highly educated scientists and managers.

This briefly describes the background against which China and the U.S. have developed the largest program of official S&T relations in the world. The umbrella S&T agreement, signed in 1979 and extended for another five years in 1984, now embraces sub-agreements or protocols providing for cooperation in 27 fields. The areas range from the very theoretical such as high-energy physics, to the very practical, such as statistics, management, water resources development, building construction, and telecommunications.

Various elements in the S&T relationship directly address each of the three obstacles: in energy, the U.S. has cooperation in nuclear safety and a reimbursable program in hydropower; in transportation, there is cooperation in navigation, port development, highways and in railways; and in communications, activity under the new telecommunications protocol has begun.

Indonesia

S&T cooperation offers the U.S. an excellent opportunity to play a major, highly visible role in Indonesian development, enhancing overall U.S.-Indonesia bilateral relations and fostering increased sales of U.S. goods and services. The government of Indonesia has designated the S&T area as a spearhead for overall economic growth in the years ahead, and recognizes that in many S&T areas the U.S. is the world leader. President Soeharto and many of his key ministers are committed to the use of high technology to facilitate the development of Indonesia's human and natural resources.

The long association between the two countries in S&T undertakings, the many shared values, and the close links between the respective Indonesian and U.S. public and private S&T communities, have established a strong foundation for closer cooperation. The U.S. and Indonesia in the past several years have concluded a series of cooperative technology agreements, most importantly the 1978 U.S.-Indonesia bilateral S&T agreement that was extended for another five years in 1984.

Areas of cooperation include aerospace, meteorology, peaceful nuclear technology, geosciences, oceanography, energy technology, rural development, health and family planning, and specialized training. Funding for these activities comes from a variety of sources such as AID, the Asian Development Bank (ADB) and agency domestic budgets. The U.S. has enhanced bilateral cooperative efforts with Indonesia in virt lly all of these areas during the past year. For example, the U.S. approved the priority launch of an Indonesian telecommunications satellite; a bilateral nuclear steering committee agreement was concluded; several agreements in the geosciences were finalized; and the AID programs related to S&T were continued.

Japan

S&T cooperation has served an overriding U.S. foreign policy interest for more than 30 years with Japan. The original objective was to integrate Japan into the community of advanced Western industrial democracies. That objective having been achieved with resounding success, efforts are now being made to refocus cooperation under the U.S.-Japan Agreement on Cooperation in Research and Development in Science and Technology on terms appropriate to the two countries' resources and priorities today.

Japan's access to Western S&T has made a major contribution to its development as a stable and prosperous democracy closely allied with the U.S. and the West. It serves as an element of security and stability for the East Asian Pacific region as a whole. Japan has emerged as one of the world leaders in S&T development in an impressive range of advanced technologies. This has introduced a new dimension into the bilateral relationship: the importance of the U.S. remaining abreast of Japanese S&T activities. Continued and expanded bilateral S&T cooperation with Japan in the present circumstances provides vital insights into Japanese developments of significance to the U.S. This S&T cooperation also offers the opportunity for joint research efforts that would otherwise be too expensive or risky for either country to undertake separately. Japanese government agencies and laboratories provide opportunities for U.S. scientists to participate in research sponsored by the Japanese government, and a number of U.S. scientists have taken advantage of these opportunities to maintain familiarity with the latest S&T developments in Japan. Recent legislation authorizes the Department of Commerce (DOC) to establish a channel for translating and disseminating the latest Japanese S&T literature to U.S. scientists. This will provide another dimension to the cooperative relationship.

Formal cooperation in basic science and engineering research commenced in 1961 when President Kennedy and Prime Minister Ikeda established the U.S.-Japan Committee on Scientific Cooperation. In October, 1986 the two countries celebrated the 25th anniversary of this bilateral agreement in the basic sciences. The Committee is the oldest of its kind and has served as a model for bilateral S&T agreements with many other countries.

A large number of scientists and engineers of both countries have established close professional relationships in the past 25 years. Access to advanced public research facilities and information in Japan by U.S. scientists consequently is excellent, particularly in the field of environmental studies and the management of water and bottom-sediment pollution. Access to private industrial facilities and government-backed public corporations and special projects such as Exploratory Research in Advanced Technologies (ERATO) and the Institute for New Generation Computer Technologies (ICOT), a project aimed at developing a Fifth Generation computer, also is beginning to occur. For example, in June, 1986 NSF and ICOT signed an agreement whereby American researchers will be able to engage in cooperative research beginning in 1987. This background puts the U.S. in particularly good position to participate in, and benefit from, new Japanese science policy that for the first time places a premium on basic research and the production of new knowledge.

The U.S.-Japan Science and Technology Agreement signed in 1980 by President Carter and Prime Minister Ohira was renewed in May, 1985 for two years. Discussions regarding renewal in 1987 are underway with Japanese officials. The U.S. proposals, developed by the Committee on International Science and Technology (CISET), aim to establish a firm partnership of peers that assures equity of access and scientific benefit in all cooperative activities, in spite of differing national R&D policies and structures.

Republic of Korea

The Republic of Korea views S&T cooperation as an important part of its overall diplomatic relations with the U.S. Scientific research in Korea is focused primarily on commercial application to bolster its export-driven economy. The Koreans also seek stronger collaboration with the U.S. in order to promote a better balance between Japanese and U.S. involvement in the Korean economy. While both sides benefit from broad S&T cooperation, questions concerning technology transfer and protection of intellectual property still must be addressed.

U.S.-Korea cooperation in S&T has played a major role in creating the technical infrastructure needed for commercial R&D. U.S. assistance was instrumental in establishing the central governmental research institutes that provide industrial support and lead technology development efforts. Current S&T cooperation outside the defense community is mostly informal, based on the personal contacts made while Korean scientists and engineers were students in the U.S.

The U.S. and Korea first signed a five year umbrella S&T agreement in November, 1976. It was renewed in 1981 for five years and is expected to be renewed again in November, 1986. However, at least eight U.S. agencies have active programs under the agreement and generally are pleased with the results. DOE exchanges information on coal utilization and technology. A large number of exchanges take place between NSF and the Korea Science and Engineering Foundation (KOSEF) on joint research projects. FDA and NIH cooperate with Korean scientists in medical research.

Thailand

Official U.S.-Thailand cooperation in S&T has become a very visible and important area of bilateral relations between the two countries. The largest element of this cooperation is the extensive and growing AID S&T program. This program centers around the S&T for Development Project (STDP). It has focused on the establishment and institutionalization of the S&T Development Board (STDB), an organization created to oversee implementation of activities associated with the STDP. Government-to-government assistance and cooperation in S&T is regarded by the Thais as the special province of the Americans due in large part to the extensive ties the scientific community of Thailand has with the U.S. and the commitment of AID to S&T development. The recently prepared sixth Thai five-year plan contains language clearly indicating the S&T promotional and developmental activities that will be carried out in connection with the STDP. These activities will constitute the lion's share of all new S&T activities to be conducted by the Thai government during the sixth plan period. The S&T community in Thailand provides a growing bridge between the traditionally important civil service and universities, and the increasingly significant professional management group of the modern private sector. U.S. interaction with the S&T sector will strenghten ties between both communities.

Malaysia

The overall level of U.S.-Malaysia S&T cooperation expanded significantly in FY 1986. The commitment of more resources to S&T cooperation, particularly in the absence of a bilateral AID program or an umbrella agreement, is an important visible demonstration of U.S. willingness to help Malaysia with its development. The U.S. gives recognition to the success that Malaysia already has achieved in development and to the quality of its existing S&T establishment by working toward a mutually beneficial S&T relationship.

The Acting Science Advisor to the President and the Deputy Director of NSF led a group of 20 U.S. participants in the First ASEAN Science and Technology Week in FY 1986. The size and variety of the delegation demonstrated U.S. commitment to its role as an ASEAN dialogue partner as well as respect for the S&T community of Malaysia The delegation included representatives from government, universities and the private sector.

Africa, The Near East, and South Asia

Egypt

The number of cooperative S&T projects between the U.S. and Egypt has fallen substantially with the depletion of Special Foreign Currency funds. Several agencies still are conducting projects funded earlier for which all SFC funds have not been expended. USDA, which is able to purchase foreign currencies whether excess or not, has a large program and has four active grants worth approximately $3.9 million. Most S&T cooperation with Egypt now is carried out under AID auspices.

S&T cooperation between the two countries is covered by a 5-year agreement signed in 1981. OES Assistant Secretary Negroponte visited Cairo in November, 1986 and signed an agreement extending the original umbrella agreement for an additional five years.

India

S&T cooperation plays a key role in the overall U.S.-India relationship. India under Prime Minister Rajiv Gandhi views S&T as an important factor in the country's race to achieve developed status. Prime Minister Gandhi has stated that he does not want India to miss the electronic revolution as, he says, it missed the Industrial Revolution. Coupled with India's large pool of scientific personnel and expertise in scientific research, this impulse makes S&T cooperation between the U.S. and India both natural and desirable. A report released by the Embassy in early 1986 showed that over 259 projects were underway.

Bilateral S&T cooperation is carried out in part under the Indo-U.S. Subcommission on Science and Technology, which held its eighth meeting at Washington in September, 1986. Projects in progress under the Subcommission increased from 61 to 87, and the dollar value from $10 million to $16.5 million since the previous Subcommission meeting in April, 1985. Scientific activities conducted under the Subcommission are financed largely from money set aside for a U.S.-India Fund for Cultural, Educational and Scientific Cooperation (USIF), authorized by Congress in 1984 and funded with $110 million worth of U.S.-owned Indian rupees. Negotiations with India on the establishment of this fund have not yet been completed. Pending a final agreement, interest earnings from the endowment are being used to fund projects.

The Indo-U.S. Presidential S&T initiative (STI) begun in 1983, continues to be both visible and important. The visit of the President's Acting Science Advisor, Dr. John McTague, in 1986, received wide publicity; he was able to meet senior scientific officials in Delhi, Bombay, and Bangalore. A major Indo-U.S. meeting in August on biological nitrogen fixation and increasing the efficiency of nitrogen fertilizer was held at Davis, California. This meeting showed the program's considerable success and its impact on Indian agricultural research. Knowledge gained from the STI program is benefitting AID programs in Thailand, Indonesia, and Africa.

In Indo-U.S. health research, the Walter Reed Army Research Institute has been screening new anti-malaria drugs in rhesus monkeys with promising results that have potential commercial interest. India also has offered a unique opportunity for scientists to work in tropical diseases. Filariasis research done by an NIH scientist in India was an important factor in his being selected as the chairman of the WHO steering committee on filariasis. The NIH program with India's central drug research institute has employed recombinant interferon supplied by the U.S. firm Genentech to show the first evidence of human gamma interferon suppression of experimental malaria.

Bilateral collaboration under the STI is strengthening Indian research capacity while advancing knowledge on specific topics. Indo-U.S. monsoon collaboration is strengthening the research orientation and capability of the Indian Department of Meteorology. Indo-U.S. contacts also have led to increased Indian funding for biotechnology programs and research, and to the creation of a Department of Biotechnology to oversee this important field in India's future.

An overview meeting of STI was held at NAS in September. The attendance of the acting White House Science Advisor and the President of NAS at that meeting testified to the high level commitment of the U.S. to the STI. As telling evidence of the value U.S. technical agencies attach to STI, participating agencies pay for their STI programs out of their own funding.

AID continues to develop major programs in India. The high regard for U.S. S&T in India allows considerable flexibility in developing these programs. In addition, AID is working closely with other U.S. technical agencies such as NAS, NIH, and EPA in developing new projects in India. A new $15 million AID program called PACT (Program for Advanced Commercial Technology), that will assist Indo-U.S. private sector joint ventures, recently has received high level Indian support and wide media publicity.

Israel

The U.S. both contributes to Israel's S&T capabilities and reaps benefits in the form of new product development from the cooperative S&T relationship. Israeli technological innovations tend to be highly specialized and designed to be competitive in world markets, yielding high returns on investment.

The best examples of U.S.-Israeli collaboration in S&T are the three binational research foundations, each maintaining an endowment with equal contributions from the two governments. The Binational Science Foundation (BSF) funded over 300 projects in 1986 with the $9 million earned by its $100 million endowment. These joint projects in a wide range of science disciplines were chosen on the basis of technical merit, cooperative involvement, and general interest to the two governments. The Binational Agricultural Research and Development Foundation (BARD) funded more than 200 projects from its $8.7 million interest earnings. The Binational Industrial Research and Development Foundation (BIRD) supports U.S.-Israel company partnerships that show R&D efforts with potential for development and commercialization of innovative products or processes. BIRD is a private sector oriented program that receives investment returns and modest royalties from successful ventures. The estimated sale of BIRD products was $110 million in 1986, and BIRD received royalties of $650,000. There were 37 new projects started in 1986 supported by the $7.6 million in BIRD interest earnings.

In addition to the binational foundations, a number of U.S. agencies have bilateral arrangements with their Israeli counterparts. DHHS is in the second year of its renewed agreement with Israel's Ministry of Health. USGS is working with the Israeli Earth Science Research Administration to install, maintain, collect, and transmit data from a seismic research observatory in Israel. This highly advanced seismometer, one of only 15 in the world, vastly will improve the quality of geophysical data on the Eurasian landmass. NSF is in the second year of a five-year agreement with Israel's National Council for Research and Development (NCRD) to exchange scientists and conduct workshops and seminars in natural, social, and engineering sciences, and mathematics.

U.S.-Israel cooperation in energy, space, defense research, and AID programs (including trilateral cooperation between the U.S., Israel, and Egypt) are covered in other sections of this report.

Latin America

Argentina

Argentina has long ranked high in S&T achievements, particularly in nuclear science and biomedicine. Three Argentine researchers hold Nobel Prizes in chemistry, physiology, and medicine. The basic agreement governing U.S.-Argentina S&T cooperation was signed in 1972, and renewed in 1977 and 1982. NSF and the Argentine National Council for Scientific and Technical Research are the executive agencies for a wide range of joint research projects, seminars, workshops, and scientist exchange programs.

Cooperative projects have been carried out in physics, mathematics, marine geology, biology and agriculture. A joint Halley's Comet observation also was conducted from February to April, 1986. Joint activities between NIH and Argentine biomedical institutions have been close and long-standing, particularly in fields such as infectious diseases, child health and human development, eye diseases, and cancer.

Argentina has developed the most advanced nuclear program in Latin America, and has become a supplier of nuclear material and technology to the Third World. Cooperation with the U.S. is restricted by the U.S. Nuclear Non-Proliferation Act and by differences in nuclear policy and technology. Despite these differences, there is mutual interest in the peaceful use of nuclear energy.

Unstable political and economic conditions in the past dampened S&T development in Argentina, and many scientists left to work elsewhere. The Alfonsin government has recognized the need to close the widening technological gap that puts Argentina in danger of becoming part of the Third World. The government's efforts to revitalize Argentine S&T capabilities and achievements has included a campaign to attract emigre scientists back, and to facilitate the connections between S&T and the production sectors of the economy. However, the severe national debt, inflation, and balance-of-payments problems have slowed S&T recovery efforts and have also begun to limit the size of the joint S&T program.

Brazil

U.S.-Brazilian S&T relations have progressed steadily since the current civilian government was elected in 1985. The Brazilian Congress approved ratification of a renegotiated U.S.-Brazil bilateral S&T cooperation agreement in April, 1986. A special Science and Technology Initiative (STI) subsequently was announced by President Reagan and Brazilian President Sarney during a recent state visit to Washington in September. The initiative calls for a binational panel of eminent scientists, engineers, and policy advisors to recommend selected mutual S&T priorities to the two governments. The presidential STI is expected to strengthen the well-regarded cooperation between U.S. and Brazilian researchers.

The interest in closer S&T collaboration voiced by the Brazilian and U.S. scientific communities clearly is shared by Brazilian and U.S. authorities.

Colombia

Bilateral S&T programs continue to play an important role in U.S. diplomatic relationships with Colombia. The most-publicized U.S. S&T contribution to Colombia over the past year has been to improve volcano and seismic monitoring in connection with the Nevado del Ruiz disaster. This cooperation involved more than 20 scientists from USGS working with their Colombian counterparts to monitor deformation, seismic, and mud flow activity. By providing state-of-the-art equipment and training for Colombian vulcanologists, these efforts have allowed Colombia to develop one of the strongest volcano observation stations in the hemisphere.

AID is providing funds for other S&T projects in agricultural research, the distribution of technical information, assistance to small businesses in utilizing appropriate technologies, and child survival. The U.S. Federal Aviation Administration (FAA) continues to work very closely with the Colombian Civil Aviation Authorities under an MOU for Technical Assistance that was signed on February 20, 1986.

Experts and technology provided by the U.S. to help Colombia and its neighbors interdict and eradicate illegal drugs have strengthened regional relationships. The U.S. Embassy manages a narcotics control assistance program with funds made available from the Foreign Assistance Act.

Mexico

Mexico and the U.S. have 16 bilateral S&T agreements in force dealing with a broad range of scientific and technical problems of common concern. They include nuclear safety, enviromental problems along the border, cooperation in biomedical sciences, and joint R&D in the preservation of species and endangered ecosystems.

Perhaps the most important effort in this regard is the continuing work of the two governments in the protection and improvement of the border environment. The 1983 agreement in this field, signed by Presidents Reagan and De la Madrid, has served effectively as a vehicle to address common enviromental problems along the 2,000 mile U.S.-Mexico frontier. The national coordinators of the agreement signed an annex on September 10, 1986 to expand common efforts for the control of illegal traffic in hazardous waste. Agreements to deal with serious air and water pollution in the border region also are near completion. Specific actions have been taken by both nations to control water pollution in the San Diego and Tijuana region, and air pollution in the Arizona-Sonora "smelter triangle". Recent efforts also have been made to upgrade joint performance in case of an oil spill that could threaten beaches or the marine ecology in either nation. This effort has been carried out under the U.S.-Mexican Agreement of Cooperation for the Protection of the Marine Environment.

The single most important S&T event in FY 1986 was the flight of space shuttle mission 61B that carried a Mexican astronaut and a Mexican communications satellite payload. The Mexican astronaut, Dr. Rodolfo Neri Vela, is widely viewed in Mexico as a non-partisan national hero. The launching of Mexican satellite Morelos II and Dr. Neri's exploits in space were given extensive national press coverage, and the recent visit to Mexico of the full crew of the 61B mission was received enthusiastically by the Mexican political and scientific elite.

A wide variety of U.S. agencies including NSF, HHS, NIH, USDA, USGS, EPA, and NOAA, participate in bilateral S&T activities with Mexico. Programs like that of NSF have included the exchange of S&T information, the exchange and training of scientists and technical personnel, and joint or coordinated implementation of research projects and programs including workshops and conferences in mutually interesting areas of expertise.

There have been some worrisome developments in regard to cooperative scientific research with Mexico. In particular, the Secretariat of Foreign Relations has imposed extremely restrictive regulations on foreign researchers wishing to conduct cooperative projects in Mexico. These restrictions are felt to be inconsistent with exchanges of personnel and ideas necessary for the success of scientific enterprise and Mexico's own development.

Chapter 5 - AGRICULTURE IN INTERNATIONAL S&T COOPERATION

This chapter is devoted to major changes and innovations that occurred in agricultural scientific exchanges during FY 1986. As in the past, the Department of Agriculture (USDA) actively cooperated with AID, the Food and Agriculture Organization of the U.N. (FAO), the Interamerican Institute of Agricultural Sciences, the World Bank and other Ministries of Agriculture in providing agricultural experts on a reimbursable basis. The goals of USDA cooperative activities are improvement of the productivity of U.S. agriculture, conservation of agricultural resources, and expansion of U.S. agricultural exports.

S&T Cooperation by Individual USDA Agencies

Office of International Cooperation and Development (OICD)

OICD cooperates with AID and other agencies in recruiting agricultural technicians on a reimbursable basis. The office also has administrative control of several joint research projects and administers USDA bilateral scientific and technical exchange programs.

Algeria. The U.S. and Algeria have agreed to build a Friendship Forest in Algiers. Designed originally as a symbol of the growing friendship between the peoples of the two countries, the forest also will be a showplace of tree species from the U.S., Europe, and Northern Africa. U.S. and Algerian scientists will have a separate area available to them for experiments and research into common forestry problems.

The site chosen is next to the Zoological Park overlooking Algiers and is a popular tourist spot. Picnic areas and informative signs are an integral part of the forest that will serve as an educational tool for all visitors.

The forest was designed by USDA Forest Service technicians in close cooperation with Algerian counterparts. U.S. funding is coming entirely from the private sector; donations of trees and seedlings already have been sent to Algeria where they are being stored in greenhouses pending completion of final design plans and construction. Overall coordination on the U.S. side has been provided by the USDA Forest Service and the OICD.

People's Republic of China (PRC). The meeting of the U.S.-PRC Joint Working Group for Agricultural Cooperation in Science and Technology was held at Beijing in April, 1986. This meeting formally marked resumption of U.S.-PRC scientific and technical exchange activities. Since April, the OICD Science and Technology Cooperation Program (STC) has administered 13 scientific and technical exchanges with the PRC, including seven U.S. teams and six Chinese teams. These exchanges have proved highly beneficial to both countries.

The Forest Service through the S&T program was able to resume cooperation in gypsy moth control (detailed in the Forest Service section of this chapter). A team of U.S. scientists also visited China to initiate a cooperative program in forest pathology. Through this exchange, U.S. scientists have established fora for future exchanges of disease control methodology, collection of genetic materials for use in breeding disease-resistant tree species, and sharing of disease information relevant to the numerous tree species common to both American and Chinese forests.

The 1986 exchange program also included activities in the areas of animal health, grasshopper management, agricultural information and reporting systems, and soil and water conservation.

Czechoslovakia. Preliminary steps are underway to begin exchanges in FY 1987. This is a direct result of the umbrella agreement signed this past spring by the Department of State and the Czech Ministry of Foreign Affairs.

Egypt-Israel-U.S. Cooperation in Agricultural Research. As part of its Regional Cooperation Program supporting the Middle East Peace Process, AID supports four major S&T projects, two of which are in agriculture. American involvement, aside from project administration, typically is at the individual scientist level. OICD administers the Trinational Agricultural Technology Exchange and Cooperation (TATEC) research project, which is in its second year of activity. The San Diego State University Foundation has administered the Cooperative Arid Lands Agricultural Research (CALAR) project since 1982.

OICD officials and TATEC researchers joined over seventy participants in a workshop held at Washington in May, 1986 to review the achievements of, and future prospects for, the AID 5-year-old Middle East Regional Cooperation Program. Following the conference, the House Foreign Affairs Subcommittee on Europe and the Middle East held hearings on the program. Senior Egyptians and Israelis involved in the four active natural science projects in agriculture, health, and marine sciences testified on the program's achievements. A panel of interested Middle East individuals addressed the program's potential for building peace in the region through cooperative efforts in the social sciences.

The TATEC project administered by OICD produced its first publication co-authored by Egyptian and Israeli investigators in August, 1986; it summarizes the past several years' joint research. These scientists had investigated the application of solar heat via transparent plastic tarping to remove soilborne diseases from fields before sowing. Support came from several sources, including OICD.

The joint Egyptian-Israel Egypt's Furrow-Irrigated Fields project found that in the soil solarization effectively controls many kinds of weeds, certain nematodes, and soilborne diseases such as corky root and root knot. The process also improves plant growth and increases yields by 25 to 432 percent in broadbeans, onions, tomatoes, and strawberries in various soils. Solarization also was found to decrease soil salinity in areas having high water tables.

The jointly authored article "Effectiveness of Soil Solarization in Furrow-Irrigated Egyptian Soils" currently is under review by referreed scientific journals. These scientists from nations formerly at war are now willing to announce to their colleagues worldwide the duration and extent of their quiet collaboration. This demonstrates the interpersonal trust and interinstitutional linkages stemming from international S&T cooperation, and the recent improvements in the bilateral political setting that have made such publicity possible.

India and Pakistan. Heliothis and nematology workshops held respectively in India and Pakistan were attended by scientists of both countries. Indian and Pakistani agricultural research officials now maintain direct contact with each other, partly as a result of these workshops. In all, 11 nations were represented at the heliothis workshop in India, and six at the nematology conference in Pakistan.

The USDA/OICD Foreign Currency Research Programs with India and Pakistan made these workshops possible and facilitated the foreign scientists' participation in them. The OICD Far Eastern Regional Research Office in New Delhi administers both programs, which together sponsor about $3 million per year in fully funded new projects.

Beginning in FY 1986, funding for the USDA/OICD cooperative research program with India is being provided by the U.S.-India Fund (USIF), a rupee-denominated endowment having a principal of $110 million equivalent. When the USIF is fully operational, agricultural research funding is expected to average about $2 million equivalent annually.

Israel. The U.S.-Israel Binational Agricultural Research and Development (BARD) Fund operates from a $110 million endowment used to encourage and support agricultural research of mutual benefit. A total of $55 million has now been provided by each country, and 374 proposals with a total value of $63 million have been funded. A postdoctoral fellowship program was begun in FY 1986, and has the goal of helping young American and Israeli scientists become established in the scientific community.

Mexico. USDA and the Secretariat of Agriculture and Hydraulic Resources agreed to continue collaboration in an effort to strengthen areas of mutual benefit. The theme areas for the period 1986 to 1988 include soil and water management, Africanized honey bees, plant protection and quarantine (alternatives to the use of EDB insecticide spray), forestry, animal production (embryo transplants), and biologic residue analysis.

Romania. Bilateral exchanges were resumed with Romania during FY 1986 as a direct result of resumption of meetings of the U.S.-Romania Joint Working Group on Agriculture that took place in April at Washington. The meeting was held in conjunction with the Joint Economic Commission that was chaired by the Department of Commerce. The Romanians invited USDA to a spring 1987 meeting at Bucharest.

Spain. At the end of the OICD program's second year of operation, 39 collaborative agricultural research projects were underway at an estimated cost of $7 million. These projects were selected on the basis of benefits to U.S. and Spanish agriculture, and cover research on animal and plant productivity, animal and plant health, forest productivity and fire prevention, water use efficiency, soil conservation, and agricultural economics. A project in the increasingly important field of fish-farming (aquaculture) was begun recently. Other program activities include visiting scientist awards and joint seminars.

Midterm results from the on-going agricultural research projects now are appearing in the scientific literature. For example, a collaborative research study on the transfer of sheep embryoes carried out jointly by the University of Minnesota and the Instituto Nacional de Investigaciones Agrarios has published research results in Cryobiology and in the Scientific Journal Series of the Minnesota Agricultural Experiment Station. The technological progress described in these publications will accelerate the genetic improvement of farm animals.

A joint agricultural engineering project by the University of California at Davis and the E.T.S.I. Polytechnical University, Madrid has published early results from a study of mechanical bruising during the handling of pears. The investigators are developing criteria for designing fruit handling equipment in order to minimize mechanical impact. Early experimental results were presented in a formal paper delivered at the 1985 meeting of the American Society of Agricultural Engineers. Another paper will be presented before the II World Congress of Food Technology to be held at Barcelona in March, 1987.

Uruguay. To assist the newly-elected democratic government in Uruguay, USDA sent a fact-finding feasibility team to Uruguay, August 27 through 29, 1986 to follow-up on President Sanguinetti's request to President Reagan to identify areas of government and private-sector bilateral cooperation in the agriculture sector. The team has recommended a number of areas for joint follow-up involving USDA and the Uruguayan Government including the visit of a senior U.S. agricultural information specialist to identify mutually beneficial data sources in Uruguay and explore the potential for continuing data exchanges, and the visit of a USDA veterinarian to continue work on the effects of thermal beef processing on the foot-and-mouth disease virus.

Yugoslavia. The U.S.-Yugoslav cooperative research program administered by OICD has sponsored scientists in developing the first valid test for detecting listeriosis among cattle. U.S. and Yugoslav researchers devised a skin test, much like the tuberculosis test for humans, that confirms the presence of bacterial species in cattle. Almost all mammals and birds are susceptible to this disease, but cattle, goats, swine, and poultry are the most likely victims. In humans, listeriosis affects only those who are immuno compromised; infection usually occurs from consuming products from infected animals.

Listeriosis mimics other diseases in both animals and humans, and misdiagnosis has led to a high mortality rate. The U.S. Centers for Disease Control (CDC) reports that about 1,500 cases of listeriosis in humans occur annually in the U.S. In 1983, 49 cases of human listeriosis in Massachusetts were caused by contaminated milk; 14 persons in this group eventually died.

Another project in the U.S.-Yugoslav agricultural research program has studied the temperatures needed to make pasteurized milk safe, and whether the listeria bacterium survives cheese manufacturing processes. This work builds upon the joint diagnostic research and corroborates studies done elsewhere that indicate that present pasteurization temperatures for milk and cheese processing may be too low.

Additional studies will have an epidemiologic focus, and will examine how the disease spreads among humans. Researchers hope to continue making progress in the study of listeriosis by using a multidisciplinary team of veterinarians, physicians, and food technologists from both the U.S. and Yugoslavia.

Soil Conservation Service (SCS)

The SCS participates in OICD activities in the International Scientific and Technical Cooperation (STC) program with other countries that are involved in active USDA agricultural exchange agreements. During FY 1986, SCS participated in seven exchanges through OICD. Individual SCS employees traveled to Mexico and to China. Teams of two SCS specialists also visited China, Bulgaria, Romania, and Venezuela; three specialists participated in an exchange with Hungary. SCS participated in STC negotiations with China in addition to hosting STC delegations from Algeria, France, and China.

Approximately 333 workdays of SCS staff time was provided to carry out the STC activities, amounting to about $90,000 in salaries. An additional $20,000 was expended for travel and per diem. Foreign governments contributed approximately equal specialist time and funding.

SCS participation in the USDA international STC activity promotes sharing of SCS conservation knowledge and the opportunity to learn from other countries with similar water shortage problems, severe soil erosion, and problems of improper land use. SCS staff members share their expertise with others in these international exchanges, and at the same time learn about conservation technologies being developed in other countries. Long-term benefits are reflected in economic savings through application of these technologies to U.S. farmland.

Forest Service (FS)

18th International Union of Forestry Research Organizations (IUFRO) World Congress. The 18th IUFRO World Congress, held at Ljubljana, Yugoslavia on September 7-21, 1986, was attended by 1800 forestry researchers from 60 countries. Approximately 50 U.S. Federal employees participated, 40 of them from the Forest Service; the total U.S. attendance was approximately 125 individuals. Direct costs of federal participation for travel and registration were about $100,000, plus an equal amount of salaries. Costs incurred by other countries varied widely depending upon size of delegation and distance traveled. The cost to various jurisdictions within Yugoslavia probably exceeded $500,000, but this is an unverified rough estimate.

Scientific and technical benefits are difficult to estimate quantitatively, but they were substantial. Every participant presented at least one paper or poster, and attended hours of technical sessions and field excursions dealing with recent research results and current methods. Subject matter included the entire field of forestry and forest products. The IUFRO Congress gave special emphasis to air-pollution-related forest decline in temperate regions and to deforestation in tropic regions.

The IUFRO Congress was attended by many researchers from the world's important forested regions that have technical ability equal to the U.S. For example, large delegations were present from Canada, FRG, Japan, and the USSR. Professional relationships were begun, continued, and strengthened and will give our scientists access to new technology as it continues to develop elsewhere in the world.

The 19th IUFRO World Congress will be held at Montreal, Canada in 1990, and USDA expects U.S. participation to be even stronger than this year. Several post-IUFRO Congress scientific excursions will be hosted by the U.S.

U.S.-PRC Cooperation on Biologic Control of Forest Insects. There has been an excellent scientific relationship since 1981 between researchers in the U.S. (i.e., USDA Forest Service) and the PRC (i.e., Ministry of Forestry) on a mutual problem: the need to control the gypsy moth in the U.S. and the pine caterpiller in the PRC. The interest of the Chinese in reducing their dependence upon pesticides is strong, and thus Integrated Pest Management (IPM) is a very important part of their forest management activities.

U.S. scientists and managers have benefited and will continue to benefit from the rapid development of IPM strategies for managed forests in the PRC. A notable example is the recent characterization of a diverse natural parasite complex responsible for gypsy moth mortality in the PRC that is not found in the U.S. Data from these investigations have enabled U.S. scientists to select promising parasites for use as biologic control agents against the gypsy moth in the U.S. Propagation of the Chinese gypsy moth under quarantine also suggests that a yellow color-morph of the Chinese strain is maternally inherited, and thus might be easily developed as a visible genetic marker for enhancing study of dispersal and population dynamics. U.S. scientists have determined that the pheromone used for detection and monitoring of the gypsy moth in the U.S. also attracts the Chinese strain of gypsy moth, as well as two other species of Lymantrids. This suggests the possibility of laboratory breeding for use of hybrid sterility in a sterile male control program.

The Chinese likewise have benefited from exposure to U.S. monitoring and laboratory rearing techniques. Rearing of laboratory populations for research and control programs has been highly successful in the U.S. while such has not been the case in the past in the PRC. A three-person team from the PRC visited the U.S. under the exchange program in 1986. Cost to the U.S. for travel within the country was $5,800.

U.S.-USSR Cooperation on Reforestation and Afforestation. The U.S. has had an active Agreement for Cooperation with the Soviet Union in the Field of Agriculture since 1973. A team of USDA officials went to the USSR in June, 1985 and successfully negotiated an extension through 1990 of the agreement. This new agreement encompasses four areas of cooperation in forestry, including reforestation, tissue culture, gypsy moth control, and germplasm exchange.

One of the primary benefits realized to date has been the exchange of seeds of forest tree species. Almost all of the major tree species used in the U.S. in the windbreak and shelterbelt program come from foreign genetic stock. One of the objectives in the exchange with the USSR has been to obtain additional cold hardy materials for evaluation for use in shelterbelts in the northern Great Plains. U.S. scientists have received over 40 seed collections covering a variety of families, species, and provenances during the 10-year period from 1976 to 1986.

A number of experimental forests in the U.S. have been established from Soviet seed, and U.S. seed has been used in the USSR for forests. These performance trials provide data on species that might be useful in the U.S., and also give U.S. scientists a basis for advising foreign purchasers of U.S. seed on the species that would do best under various environmental conditions. Now that these experimental stands are in place, cooperating scientists continue to collect and share survival and growth data, and jointly publish manuscripts on the results at no additional cost to the exchange.

Seedling and seed physiology is another area where cooperation with the USSR has benefited the U.S. U.S. review of Soviet facilities and discussion with the scientists involved have helped the U.S. design facilities more efficiently and allowed the U.S. to conduct research more effectively. A two-person reforestation team from the U.S. visited the USSR under this exchange in 1986. Cost to the U.S. was $12,000 in travel and $3,700 in salaries.

Agricultural Research Service (ARS)

The ARS is a mission-oriented agency responsible for developing new knowledge and technology for assuring adequate supplies of high-quality, reasonably priced agricultural products and to provide for the continued improvement in the nation's standard of living by ensuring an adequate supply of high quality food and fiber.

The primary objective of overseas research by ARS is to provide support for domestic national programs. Research conducted abroad removes such constraints as lack of unique facilities, high costs, risk of introducing pests into the U.S., and nonavailability of natural pest habitats or of an essential component in the export network.

The overseas activities of ARS are carried out at six locations, with three program areas, as follows:

1. Crop Production Efficiency Research

   Buenos Aires, Argentina -- Biological Control of Weeds Research Laboratory

   Behoust, France -- European Parasite Laboratory

   Rome, Italy -- Biological Control of Weeds Laboratory

   Seoul, Korea -- Asian Parasite Laboratory

2. Animal Production Efficiency Research

   Nairobi, Kenya -- Animal Disease Laboratory

3. Research to Expand Agricultural Exports

   Rotterdam, The Netherlands -- European Marketing Research Center

Total annual budget for the ARS laboratories is $2 million.

Organization for Economic Cooperation and Development (OECD)

OECD sponsors a cooperative research project on food production and preservation that has three main themes:

1. Nitrogen fixation by the rhizobium/legume system;
2. Photosynthesis, growth and environment;
3. Processing of plant biomass for food or chemical purposes.

The project holds annual workshops in each subject area to identify gaps in knowledge.

Fellowships are awarded in each of the main areas to advance basic knowledge in these technologies. Last year 55 fellowships were awarded. Countries participating include the U.S., Spain, FRG, Netherlands, France, New Zealand, Canada, Belgium, U.K., Yugoslavia, Sweden, Denmark, Ireland, and Switzerland. The Agricultural Research Service, USDA, has made a major contribution to this program by supplying the Head of the project for a 2-year period, February, 1986 to February, 1988.

Summary of Expenditures for S&T Cooperation, FY 1986

Foreign Currency Research with Pakistan,
Poland, Yugoslavia (supplemental), Egypt,
and Costa Rica (a)
$2,854,000

U.S.-India Fund (agriculture portion) (b)
$1,900,000

Footnotes:

(a) Three-fourths expended in support of new (FY 1986) activities.

(b) All expended in support of new (1986) activities.

Yugoslavia Joint Board Research Program (c)
$ 840,000
U.S.-Spain Binational Research (b)
$1,000,000
Collaborative Research Program (d)
$ 400,000
Trinational (Egpyt-Israel-U.S.) Agricultural Technology (TATEC) Project (e)
$ 861,000
OICD/International Research & Development (IRD) Administrative Budget
$1,154,000

Footnotes:

(c) One-third expended in support of new (1986) activities.

(d) One-half expended in support of new (1986) activities.

(e) FY 1986 expenditures only, for ongoing activity (started before 1986).

Chapter 6 - CIVIL SPACE PROGRAM

The Challenger explosion on January 28, 1986 was a tragic loss that affected the national space goals, programs, and institutions. One result of the tragedy was an outpouring of private and public sympathy from virtually every nation on earth along with broadly based support for the U.S. civil space program, its accomplishments, and the ideals it represents. The Challenger accident, and the two-year recovery time for the Space Transportation System (STS) are affecting the programs and international relations of the U.S. and other Shuttle-using nations. Other recent U.S. and non-U.S. launch vehicle experiences have also impacted on the space programs of all countries. Yet, even with disruptions, the U.S. Civil Space Program registered major progress and achievements during FY 1986.

The year was marked by great progress in the exploration and exploitation of space. The Soviet Union, European Space Agency (ESA), France, China, Japan, India, and Brazil continued strong, well-funded space programs. The People's Republic of China became a full fledged member of the space "club" with a strong national space program as well as an aggressive campaign to market commercial launch services on China's expendable launch vehicle "Long March". Japan achieved a new milestone in its program to develop an independent launch capability with the successfully launched H-1 rocket. France increased its space presence when SPOT, a highly sophisticated, commercial remote sensing satellite was launched. The world use of satellites in communication, remote sensing, and scientific research increased. The disruption of launching services in the U.S. and Europe clearly showed how much the entire world has become dependent upon the accessibility and use of space, leading to heightened attention to commercial expendable launch vehicles.

The Challenger tragedy and its aftermath focused critical attention on U.S. and world space policy. In response to this new domestic and world interest, as well as the problems resulting from uncertainties following the Challenger loss, the Department of State has broadened its diplomatic activity in the space field. In FY 1986, the Department worked closely with other government agencies, Congress, the private sector, and foreign governments to understand and evaluate the current status of programs, and to shape U.S. foreign policy related to space issues.

Space Transportation System (STS)

A number of international programs, including a West German Spacelab mission, a Mexican national communications satellite, and an Australian commercial satellite, were carried out on the Space Shuttle early in FY 1986. On January 28, 1986 the STS program suffered a major setback with the tragic Shuttle accident. Resumption of operations with improved safety is scheduled for the first quarter of 1988.

In August, 1986 the President authorized NASA to replace the Challenger, thus restoring the Shuttle fleet to four orbiters. Funding for the new Shuttle was approved in the FY 1987 budget, with its completion expected in 1991.

The President also decided that commercial and foreign payloads should not fly on the Shuttle unless they require manned presence or involve significant national security and foreign policy interests. NASA, the Department of State, and other U.S. agencies are working together to develop the best approach to rescheduling the activities of the affected nations, consistent with the President's policy decisions.

Space Station

Consultations continued during FY 1986 on the definition and preliminary design of the Space Station as outlined in Memoranda of Understanding (MOUs) signed during 1985 with Canada, Japan and ESA. The four partners agreed to a basic concept for the overall Space Station design, and each identified the major hardware it would be willing to consider as its potential contribution to the Space Station program.

Japan has proposed an attached multipurpose research and development laboratory made up of a pressurized module, an exposed workdeck, an equipment airlock, a remote manipulator, and an experiment logistics module. This hardware will provide for general S&T research, and also support the Space Station's system to handle physical objects in space, such as satellites.

Canada has offered to contribute a remote manipulator system and other associated hardware to be used for Space Station assembly and servicing.

The European Space Agency has proposed to provide a polar orbiting platform for earth remote sensing and a permanently attached pressurized laboratory. ESA and NASA also are jointly studying the concept of a man-tended, free-flying module to permit experimentation away from the main facility.

This potential international commitment in the Space Station will add roughly $4 billion to the planned initial U.S. investment. Beyond the extent of the international partners' investment, the Space Station program has an important political dimension. Envisioned as a major, long-term, manned facility that will grow throughout its lifetime, the Space Station represents a commitment by the U.S., Europe, Canada and Japan to long-term cooperation in science and technology.

Negotiations have begun on the next phases of the program: the detailed design, development, operations, and utilization of the Space Station. The Department of State is negotiating intergovernmental agreements with Canada, Japan, and ESA member governments covering the principles and legal aspects of cooperation during these phases. At the same time, NASA is negotiating Memoranda of Understanding (MOUs) with its counterpart agencies covering the technical and programmatic aspects. Completion of these agreements will complement the detailed design and development activities which the United States is planning to begin in FY 1987.

These negotiations for establishing the principles and guidelines for managing the largest complex ever put in space, crewed by nationals of several different countries, will not be easy. National pride, large investments and each partner's desire to ensure that its interests will be protected make cooperative arrangements extraordinarily complicated.

Among the desired results of such international participation are enhancing the Space Station, strengthening our relationships with our allies, and demonstrating the benefits of working with the US in space and other areas of advanced technologies. This is to be achieved while preventing adverse technology transfer and ensuring that the U.S. may use its allocation of the Space Station for any purpose consistent with U.S. law and international obligations.

Space Science

Hubble Space Telescope. The Hubble Space Telescope (HST) is the centerpiece of the NASA space astronomy program. The HST is a 2.4-meter diameter telescope which will be able to study the Universe at a wide range of wavelengths from the infrared to the ultraviolet, and will provide the best angular resolution ever achieved at these wavelengths. The telescope is currently expected to be launched in November 1988. The solar arrays and one of the science instruments for the telescope are being provided by the European Space Agency. The day-to-day operations of the observatory and routine data analysis will be executed by an international team at the Space Telescope Science Institute.

Exploration of Comet Halley. The U.S. took part in an international program to explore Comet Halley, the first space-age opportunity for such study. The International Cometary Explorer (ICE) spacecraft flew past Comet Giacobini-Zinner, then continued its voyage to monitor the solar wind upstream from Comet Halley. An international armada of spacecraft, many navigating with assistance from the NASA Deep Space Network, flew close to the comet, and an extensive network of ground observatories monitored Halley's passage. An Inter-Agency Consultative Group (IACG) was formed to coordinate and maximize the scientific data.

NASA contributed an estimated $15 million to this $715 million worldwide effort. This international cooperation was highly effective and demonstrated the value of pooling the resources of many nations toward a common goal. The participating agencies agreed upon standardized coordinate systems for data analysis. This improved the overall scientific return and will enhance the usability of the data by scientists all over the world. In addition, each country agreed to share data with the International Halley Watch. This will form a permanent Halley Archive at the Jet Propulsion Laboratory in the U.S., and at several other locations around the world for use by present and future generations of scientists.

International Solar Terrestrial Physics Program (ISTP). Following up on the definitive activities of 1985 by the ISTP, the participating agencies began obtaining national approval for their respective contributions. ISTP is a U.S.-Europe-Japan program to study the effects of space, principally plasma and solar energy flow, on Earth's global environment.

ESA has approved two missions, SOHO and Cluster, as the Solar-Terrestrial Physics cornerstone of its long-term space science plan. Japan has received approval from its government for the Geotail mission pending budget approval for U.S. participation and provision of a launch for the spacecraft.

NASA has proposed the Collaborative Solar-Terrestrial Research initiative as part of their FY 1987 budget request. This initiative includes the funds to support the U.S. participation in the Geotail, SOHO and Cluster missions, including launch services and use of the Deep Space Network for navigation and positioning.

TOPEX/POSEIDON. The proposed TOPEX program is a three-to-five year mission designed to create a three-dimensional picture of the structure and dynamics of global ocean currents. Such information would improve our understanding of the role of the oceans in climate and provide another tool for accurate weather forecasting.

Concurrently, the French Centre National d'Etudes Spatiales (CNES) has been studying a similar mission, POSEIDON. The U.S. and France have agreed to conduct a joint feasibility study for combining the two missions since both countries have common interests.

The French have offered to provide launch services for the mission, as well as radar and tracking instrumentation. NASA would provide the TOPEX satellite and other instruments. Both parties would participate in tracking and would support their scientific communities in analyzing the data.

Although NASA traditionally has opened up its scientific research programs to participation by the worldwide scientific community, U.S. policy was established when the U.S. and the Soviet Union dominated space capabilities. Now many other nations have mature space programs and are able to contribute on a more substantial basis to joint efforts, such as a French launch in the case of TOPEX/POSEIDON. The arrangement reflects a new era in international space cooperation. This acceptance of European investment in U.S. missions as a full and equal partner is a critical step for promoting continued fruitful cooperation at a time when many in Europe are calling for greater independence from the U.S. in such programs.

NASA has proposed TOPEX as a new program in its FY 1987 budget, and the French have included POSEIDON in their 1987 budget as well. The NASA funding for the life of the project is estimated at about $387 million, and the French participation at approximately $160 million.

In addition to being a proposed bilateral project between NASA and CNES, TOPEX/POSEIDON is being planned in concert with the World Ocean Circulation Experiment (WOCE), a major international oceanographic field program under the auspices of the World Climate Research Program.

Search and Rescue Satellite Systems (COSPAS/SARSAT)

The COSPAS/SARSAT program is an international cooperative effort combining the Search and Rescue Satellite-Aided Tracking system (SARSAT), of the U.S., Canada, and France with COSPAS, a similar and interoperable system deployed by the USSR. This program coordinates various satellite and ground facilities of these countries to locate downed aircraft and floundering vessels, homing in on their distress signals.

Since its start in 1982, the program has assisted in saving over 600 lives. Current or planned participants include Norway, the United Kingdom, Denmark, Sweden, Bulgaria, Brazil, Chile, India, and Finland. Spain, Italy, Switzerland, and Japan also have sent representatives to COSPAS/SARSAT meetings.

NOAA provides access to its two polar-orbiting weather satellites, and funds the cost of integrating Canadian and French instruments to these satellites. The U.S., Canada, France, the United Kingdom, and Norway also provide ground distress signal receiving stations called Local User Terminals (LUTS), as well as mission control centers. Other countries have shown interest in establishing additional LUTS. The USSR provides two polar orbiting satellites, three ground stations, and a mission control center.

This past year, members began talks on writing an intergovernmental agreement to ensure long-term continuity. The shift from the agency-to-agency to the government-to-government level reflects the increased importance of COSPAS/SARSAT. FY 1986 also marked the significant endorsement by the International Maritime Organization for establishing the 406 MHz frequency, used by COSPAS/SARSAT, as the universal distress alert and location signal.

LANDSAT

The LANDSAT program currently has two satellites in orbit, LANDSAT 4 and 5, that provide views of the Earth and its natural resources. Data are transmitted directly to two U.S. and 14 foreign ground stations. EOSAT Company completed its first year as system manager and data commercializer. ESA, Japan, India, South Africa, Canada, and the People's Republic of China renewed their LANDSAT MOU with NOAA in FY 1986.

The principal data collecting satellite is LANDSAT 5, launched in March, 1984 with an initial operational lifespan estimated at two years, but stretched since then to four years. LANDSAT 4 provides minimal data, and soon may be inoperable. The current two satellites are the only U.S. commercial space-based remote sensing system. In FY 1986 Congress provided additional funding for the construction of LANDSAT 6, subject to approval of a plan from the Administration.

International Polar-Orbiting Meteorological Satellites (IPOMS)

IPOMS was created in 1984 and provides the opportunity for member countries to coordinate their instruments and other contributions with the NOAA polar-orbiting meteorological satellite program. At its September, 1986 meeting, IPOMS refined the list of instruments to be flown on future Space Station polar platforms and discussed each country's proposed contribution. Canada, France, Italy, and the United Kingdom confirmed progress on their planned contribution; West Germany announced its plan to contribute new instruments, and Japan and Australia reported on recently initiated studies on sensor development.

IPOMS is another example of the new spirit being seen in international space programs. This is a spirit of more equal partnership in shaping goals, exchanging and coordinating resources, and sharing the costs of developing, supplying, and operating programs.

International Forum on Earth Observations Using Space Station Elements (IFEOS)

The IFEOS was formed in 1986 to provide an international forum for the Earth observation community to voice their views and concerns on the design and development of sensor systems to be placed on the polar-orbiting platforms of the Space Station. This is another example of the internationalization of space goals, and the harmonization of national space policy.

Chapter 7 - ENERGY

The Reagan Administration's goal in energy policy, as set forth in the Fifth National Energy Policy Plan (NEPP-5), released in 1985, continues to be that America should have an adequate supply of energy available at reasonable cost. The basic strategy for achieving this goal consists in maximizing reliance on free market decision-making to the extent possible, maintaining public health and safety, maintaining environmental quality, and promoting a balanced and mixed energy resource system. Energy stability and energy security are conceptual underpinnings of this strategy, leading in turn to long-term energy strength. Energy stability means that problems of energy availability are not substantial enough to destabilize the U.S. economy. Energy security means that supplies of energy at reasonable cost are available to consumers from both domestic and foreign sources, and that the nation is less vulnerable than in the past to disruptions in energy supply.

A basic thrust of NEPP-5 is that there are many reasons not to be complacent although the current energy situation appears to be comfortable. Domestic reserves of oil and gas have been falling, exploration is way down, and domestic production is expected to decline after 1990. No new nuclear power plants have been ordered in the U.S. since 1978, and 75 plants once scheduled for construction have been cancelled since then. Less than three gigawatts of new coal-fired capacity have been ordered since 1981. To protect the energy stability that has been achieved in recent years, the Administration intends to continue to work on five major aspects of energy security: emergency preparedness; domestic production; efficiency in energy use; international energy security; and, of particular importance in terms of this report, energy research and development.

U.S. Government R&D as envisaged in NEPP-5 focuses on basic research on all energy sources, as well as on the effects of energy production on human health and the environment. Efforts in the oil and gas area involve continuation of a limited Department of Energy (DOE) role in basic research supporting new and advanced ways of increasing oil recovery. DOE also will support basic research to develop methods of burning coal with greater efficiency and less adverse environmental consequences. Nuclear power remains a vital source of energy despite having lost much ground since 1978. As one element of its overall strategy, in order to ensure that nuclear power remains a viable option within the nation's energy mix, the Administration has focused R&D efforts on programs that should contribute to greater safety margins, standardized plant designs, and more usable systems.

Cooperation with other countries in promoting energy security has been a hallmark of U.S. policy since the 1970s. The overall goal of U.S. international energy policy is to maintain a stable and secure world energy environment, recognizing the interdependence as well as the independence of nations. U.S. international energy security policy is based on, and reflective of, domestic and economic policy strategies. Its major elements, as set forth in NEPP-5, include reducing government intervention to allow markets to function more freely promoting a balanced and mixed system of energy resources through diversification into coal, nuclear, and new technologies diversifying supply sources, with emphasis on trade among OECD members; encouraging greater international stock buildup and coordination of plans among International Energy Agency (IEA) members for early drawdown of stocks in the event of a major supply emergency; and improving international collaboration on R&D related to energy. The U.S. has taken a leadership role in creating and sustaining the IEA, maintained a strong role in the Nuclear Energy Agency (NEA) and the International Atomic Energy Agency (IAEA), and has undertaken numerous bilateral initiatives.

Two themes characterize international activities in energy R&D for 1986, namely international collaboration and relations with the Soviet Union. The concept of international collaboration (i.e., the pursuit of common objectives through early consultation that could lead to joint program planning and coordination) has taken root as a means to improve the effective use of R&D resources and the rate of technology development. The second theme, relations with the USSR, marks 1986 as the year when there was a revival of interest in interactions with the USSR, both as a result of meetings at the highest policy levels, and as a result of the nuclear disaster at Chernobyl.

As 1986 ended, energy R&D and related international cooperation and collaboration had taken on increasing importance. The Chernobyl accident, growing concern about the implications of atmospheric carbon dioxide buildup, abandonment of most synthetic fuel (synfuel) efforts, and the overall reduction in government and private sector energy investment due in part to the sharp drop in world oil prices, have combined to raise again the specter of increased oil dependence, sharp price increases, and energy security vulnerability in the next decade. U.S. oil imports at the end of 1986 stood some 12 percent higher than a year earlier. Firm policy decisions are required for 1987 and beyond in order to promote the development of technologies that will assure a mixed and balanced energy supply, encourage more efficient energy consumption, support safe and economic nuclear power, and minimize the environmental consequences of energy production. The vigorous pursuit of international cooperation in energy R&D in terms of achieving these goals for energy security within a regime of budget stringency will be an important element of American diplomacy.

Multilateral Developments

International Energy Agency (IEA)

The IEA was established in 1974 within the framework of the Organization of Economic Cooperation and Development (OECD) as a forum to deal with potential oil disruptions. It also considers the broader concern of energy security through measures to encourage stock building within IEA member countries in order to be better prepared for emergencies through the coordination of policies and through collaborative energy R&D. The IEA Committee on Research and Development (CRD) seeks to enhance the energy efficiency and energy security of IEA member countries through cooperative energy R&D studies and projects. IEA/CRD also provides technical advice to the Standing Group on Long Term Cooperation (SLT) and its various subgroups, and to the IEA Secretariat.

U.S. participation in IEA energy R&D activities is carried out primarily by the DOE. DOE supports CRD programs to develop new energy technologies and to utilize R&D resources effectively by participating in the four Working Groups under the CRD (*i.e.*, Fusion, Fossil Fuels, Renewables, and End-Use Technologies). DOE participates in some 30 Implementing Agreements and their numerous annexes, in national energy R&D reviews, and in various R&D policy studies. Support for these activities comes directly from DOE domestic program funds and staff, and the DOE International Affairs staff. For the most part, the agreements make possible the exchange of information, assignment of personnel, access to unique facilities, and coordination of programs that would not be possible on a multilateral basis without the CRD.

DOE does not have line items in its budget for international activities. International activities must compete within the DOE budget for priority, and are pursued only when they offer more benefit than existing domestic alternatives. DOE considers spending funds overseas only in exceptional circumstances, such as the existence of unique facilities and capabilities, or an opportunity to leverage funds in a joint undertaking. Where feasible, hardware to be provided overseas is made in the U.S. and then sent abroad for testing and development, or other uses.

IEA/CRD Initiatives Dealing with R&D Policy. The CRD brought to the attention of the IEA Governing Board in 1986 its concern over the impact of lower oil prices on energy R&D budgets. As a result, the CRD initiated an analysis of budgetary implications for energy R&D in the face of short-term oil market price fluctuations, particularly in light of the need for better information on the R&D activities of the private sector. The implications of the Chernobyl accident for energy R&D also are included in this effort. The CRD began developing specific proposals for actions to be taken in response to these events, and will prepare its recommendations for consideration by IEA Energy Ministers.

Enhanced Collaboration. Significant progress was made during 1986 in encouraging enhanced international collaboration in energy R&D through a series of workshops and thematic, in-depth reviews of selected IEA member countries. Four countries have volunteered to organize workshops. The first, co-sponsored by DOE and the IEA, was held in April, 1986 at Atlanta on the subject of coal liquefaction. The Atlanta session was well received and helped clarify the concept of international collaboration through the process of early consultation and joint program planning. Participants included representatives of IEA member nations, IEA staff officials, the European Community, and other non-IEA nations such as France, the People's Republic of China (PRC), Poland, India, South Korea, South Africa, Venezuela, and Yugoslavia. DOE also participated in a workshop on pressurized fluidized bed combustion hosted by Sweden in October, and a workshop on flue gas treatment hosted by Japan in November.

Thematic, in-depth reviews of IEA countries was an innovation begun in 1986 with focus on clean coal utilization and the prospects of international collaboration in the development of clean-coal technology. The U.S. was one of the countries selected for this type of review in 1986. The reviews are to be an aid in pointing out areas appropriate for international collaboration, and are intended to be input into the workshops.

Three new IEA Agreements were signed in 1986. The U.S., Japan, and the European Community signed the "Large Tokamak Agreement" in January; the U.S. with its large tokamak (TFTR), the European Community with its large tokamak (JET), and Japan with its large tokamak (JT-60) agreed to coordinate their research programs and to share information to ensure that these large, expensive machines are exploited to the best of the ability of the international fusion community. An agreement on multiphase flow also was signed in 1986. Under this Agreement, researchers will coordinate their national programs in common investigation of flow phenomena that affect the transportation, combustion, and conversion of fossil fuels. An Agreement on a Common Energy Technology Data Base was also concluded. Signatories to the agreement agreed to share abstracts of technical articles pertinent to energy R&D. The Office of Scientific and Technical Information acts as the international central coordinator repository and distributor for these technical abstracts.

Nuclear Energy Agency (NEA)

The OECD Nuclear Energy Agency (NEA) is a companion organization to the IEA. It serves as a technical forum in which experts from member countries regularly convene to exchange information and insights in the field of nuclear power. It also functions to harmonize national approaches as much as possible, and to allow cooperation on joint projects in areas of common interest. Like the IEA, the NEA operates through a series of committees comprised of member state representatives, and supported by a secretariat. The Standing Committees include Safety of Nuclear Installations, Radioactive Waste Management, Nuclear Fuel Cycle, and Radiation Protection and Public Health.

In the aftermath of the nuclear accident at Chernobyl in the Soviet Union on April 26, 1986, the NEA Committee on the Safety of Nuclear Installations (CSNI) considered what additional tasks it might undertake to assist member states in areas such as severe accidents, short-term release of radioactive particles during severe accidents, and operational problems. For the latter activity, NEA had developed and implemented an Incident Reporting System consisting of a computerized data base of significant events at operating power plants used to analyze possible precursors to failure of safety systems. NEA is working with the IAEA to enhance and harmonize a similar system in Vienna.

The Committee on Radiation Protection and Public Health (CRPPH) provides for the transfer of national experience on radiologic issues and public health. CRPPH activities encompass studies of radiation exposure of personnel operating nuclear facilities and members of the general public, the transfer of radiation throughout the biosphere, and the harmonized application to commercial nuclear facilities of recommendations developed by the International Committee on Radiological Protection (ICRP). CRPPH is developing procedures and standards in response to the Chernobyl accident for radiation dose measurements and reporting, and is investigating better modes of communicating radiation issues and concepts to the general public.

The Committee on Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle (FCC) has responsibility for the assessment of past and future contributions of nuclear power to energy supplies and the impact of new technologies on these contributions. In light of Chernobyl, the FCC began two important activities in 1986. The first is a review (jointly with the IEA) of the possible impacts of the accident on OECD/NEA member nuclear programs, (e.g., a slowdown in the deployment of new generating capacity and the implications of such a slowdown for energy security). The second major focus is to convine experts to study new technologies that can augment safety and reliability of existing plants through retrofits. The experts also will consider advanced technologies leading to new reactor design concepts with passive and more forgiving safety features, such as those that respond naturally, without mechanical intervention, to limit the progress of an accident.

International Atomic Energy Agency (IAEA)

As a result of the accident at Chernobyl, the Soviet Union agreed to make a presentation August 25-29, 1986 to a special meeting of experts under the IAEA. A wealth of detailed information was provided on the cause, course, and consequence of the accident. The 13-member International Nuclear Safety Advisory Group prepared a report on the August meeting at the request of the IAEA Director General and made recommendations. The IAEA Board of Governors also submitted a number of proposals to a special session of the IAEA General Conference in September for expansion or strengthening of IAEA activities in nuclear safety.

At the Special Session of the General Conference, held September 24 to 26, two international conventions were opened for signature. They were:

1. A Convention on Early Notification of a Nuclear Accident, which will reinforce the ability of countries to deal with transboundary radiologic consequences of a significant nuclear accident; and

2. A Convention on Emergency Assistance, affirming the role of IAEA in the nuclear safety area and enhancing the ability of countries to assist each other in the event of a nuclear accident or radiologic emergency.

The two conventions were signed at the Conference by 52 IAEA member nations, including the U.S. and USSR. The Secretary of Energy signed for the U.S., subject to ratification procedures.

Energy Assistance to Developing Countries

The energy crisis appears to have abated with the drop in oil prices, but energy problems continue to pose a serious and fundamental barrier to sustained economic development in developing countries. Demand for energy in developing countries is growing faster than in the industrialized world because of high population growth, the tendency for most new industrial investment in such countries to be energy-intensive, the shift from traditional non-commercial fuels to oil and electricity, and increasing urbanization. Studies show that every 1 percent rise in developing country gross domestic product (GDP) requires a 1.3 percent rise in energy consumption. The energy requirement is closer to 2 percent for each one percent increase in agriculture. According to the U.S. Agency for International Development (AID), fossil fuel usage will have to grow between 8 percent and 12 percent per year to meet developing country demand, and the World Bank estimates developing countries will need to invest $60 billion annually in electric power in order to continue industrialization. About half this expenditure will represent foreign exchange costs.

Most of the developing country demand will be met by imported oil. Three-quarters of the countries assisted by AID rely on oil for 50 percent or more of their commercial energy requirements. Even with lower oil prices, 23 AID assisted countries are spending an average of 27 percent of their total export earnings on imported oil. Limiting imports of energy to alleviate balance of payments pressure is not a satisfactory solution since it risks stifling economic growth. This, in turn, has implications for the industrialized world in terms of global monetary stability, debt repayment, trade balances, and political stability. A temporary decline in world oil prices should not distract attention from the need to continue cooperation with developing countries in efforts to promote efficient and reliable energy use, and to develop the technology to take advantage of indigenous energy sources and reduce dependence upon imported oil.

IAEA Technical Assistance. The IAEA maintains a program of technical assistance and cooperation for developing countries as an element of support for its nuclear safeguards regime. This program provides developing countries with advice, training, and equipment for peaceful utilization of the atom in both nuclear power and non-power activities (*i.e.*, industry, agriculture and medicine). One of its purposes is to promote the transfer to developing countries of skills and knowledge relating to the peaceful uses of nuclear energy in order to accelerate and enlarge the contribution of atomic energy to global peace, health, and prosperity. Since most developing countries view efforts to ensure non-proliferation as a responsibility of the advanced nuclear powers, they consider technical assistance an appropriate trade-off for their support of IAEA safeguards.

The IAEA provides assistance in response to requests submitted by the receiving country that are evaluated on their technical merits by the agency. Assistance includes providing internationally recruited experts, equipment, supplies, and services needed for the implementation of approved projects, as well as research contracts and technical and scientific training in developed countries. Funding for the program comes from voluntary contributions to the IAEA Technical Assistance and Cooperation Fund (TACF). Donor countries, by long-standing practice, make cash contributions at the same percentage level as their base rate of assessment to the regular IAEA budget. The U.S. is assessed about 25 percent of the budget. In addition, the U.S. and other donors provide voluntary extra-budgetary contributions in the form of in-kind assistance, expert services, training, and equipment. The U.S. also has funded projects judged by the IAEA to be technically sound but for which there are no funds available from the regular TACF budget. These are known as "Footnote A" projects. The U.S., in selecting such projects, gives preferred treatment to countries that are party to the Non-Proliferation Treaty or the Treaty of Tlatelolco. All equipment and expert services purchased under U.S. funded "Footnote A" projects must be of U.S. origin.

U.S. contributions in FY 1985 and FY 1986 to the IAEA non-safeguards technical assistance and cooperation program are as shown in Table 7.1.

Table 7.1: U.S. contributions to specific IAEA programs

Provision	U.S. $ contributed (X1000)	
	FY 1986	FY 1985
Cash contribution to TACF	7,177	6,500
Footnote A projects	1,148	1,741
Training courses and in-kind assistance	964	1,185
Cost-free experts	264	300
Non-TACF funded fellowships	800	1,338
Total U.S. Contribution	$ 10,353	$ 11,064

The countries benefiting from U.S. funding of Footnote A projects in FY 1986 were Mexico, Uruguay, Peru, Yugoslavia, Ecuador, Indonesia, Egypt, Malaysia, Greece, Republic of Korea, Jamaica, Thailand, and Guatemala.

An interagency group called the International Nuclear Technical Liaison Office (INTLO) was established in 1985 by the Department of State to improve the administration and operational support and coordination of U.S. participation in the program. INTLO consists of representatives from the Department of State, DOE, the Arms Control and Disarmament Agency (ACDA), Argonne National Laboratory, and the National Academy of Sciences (NAS). The office sets policy guidelines and program direction, reviews proposals, organizes and staffs courses through Argonne and the NAS, places IAEA fellows, monitors projects, and evaluates project implementation. INTLO has met regularly in 1986, and has made progress in improving interagency coordination during its first year.

The World Bank. World Bank lending for energy projects has expanded in recent years from $1.5 billion in FY 1979 to $3.3 billion in FY 1986. The energy sector's share of the World Bank's total loans was 14.8 percent during the period 1976 to 1978, rising to 21.6 percent in the period 1979 to 1986.

A key feature of expanded energy lending by the Bank through FY 1985 had been diversification by adding loans for oil, gas, other energy sources, and energy conservation to previous lending programs for electric power, coal and pipelines. The growth in oil and gas lending peaked in FY 1985 at $900 million, falling to $250 million in FY 1986 as a result of uncertain conditions in the oil industry, policy revisions reducing lending for exploration, and slippages of projects in the pipelines. It is expected that over the next two fiscal years, such lending will recover to close to FY 85 levels, reflecting in large part increased emphasis on lending for gas development.

Electric power, including hydro, thermal and transmission/distribution, accounts for the largest share of the Bank's energy lending in developing countries, as indicated in Table 7.2.

Table 7.2: World Bank energy lending by sub-section in millions of U.S. dollars

	FY 1985	%	FY 1986	%
Electric Power	2,250	63	2,787	85
Oil and Gas	930	26	249	8
Coal	401	11	0	0
Energy Efficiency	4	-	225	7
TOTAL	3,584	100	3,261	100
Share of Total Bank Lending	24.9%		20.0%	

The World Bank and the regional development banks, such as the Asian Development Bank (ADB), African Development Bank (AFDB), and Inter-American Development Bank (IDB), as a group can be expected to allocate approximately 20 percent of their total lending to the energy sector. This is estimated at between $4.0 and $4.5 billion in FY 1986, and it can be expected to increase by $200 to $300 million annually for the remainder of the decade.

Agency for International Development (AID). For details on AID programs, see Chapter 14.

Bilateral Cooperation

U.S. Department of Energy (DOE)

DOE entered into a more active phase of cooperation with the Soviet Union in 1986, and also concluded a number of agreements and understandings with other foreign countries.

USSR. A formal agreement providing for the exchange of information on developments in nuclear fusion research was first established between the U.S. and USSR in 1958. Agreement was reached in 1973 on a 10 year exchange program involving scientific meetings and laboratory visits. This was suspended following the Soviet invasion of Afghanistan; however, the U.S. agreed to resume activities on a modest scale in 1982, and in 1983 the agreement was renewed for five years. Coordinating committees were established for work in fusion and fundamental properties of matter. There currently are 12 exchange visits annually, six from each side. Technological development information has been excluded from this exchange as it focuses on theory and experiments.

At the Geneva Summit in the fall of 1985, President Reagan and General Secretary Gorbachev agreed to a joint statement advocating "the widest practicable development of international cooperation" on controlled thermonuclear fusion for peaceful purposes. The U.S. and its potential partners in such a collaborative effort now are considering the most feasible options for implementing this concept. Critical long-term Western technology security and economic interests will continue as major factors determining the nature and scope of fusion cooperation.

In early 1986, the Soviets proposed that the U.S.-USSR Joint Committee (formed under the 1973 Agreement for Cooperation in Peaceful Uses of Atomic Energy and which had not met since 1978) meet again to review activities and approve a program for future work. The policy level Joint Committee met in August, 1986 at Moscow. The U.S. delegation included representatives from the Nuclear Regulatory Commission (NRC), the Department of State, and DOE, and was headed by Dr. Alvin Trivelpiece, Director of the DOE Office of Energy Research. In addition to discussions on fusion and high energy physics programs, and technical tours, the U.S. delegation also was able to tour the BN-600 fast breeder reactor that is in an area normally closed to foreigners. Several days before the special Soviet briefing to the IAEA on Chernobyl, the delegation was briefed in a special session by the Soviets on the events that led to the accident.

The Joint Committee agreed that the Fusion Power Coordinating Committee should explore the concept of joint program planning in addition to reviewing each side's research program and program of exchanges. The Joint Committee accomplished this objective in September. The Joint Committee also encouraged the U.S.-USSR Coordinating Committee on Research on the Fundamental Properties of Matter to search for new areas of cooperative research when it meets in 1987.

The Joint Committee agreed to revive two dormant areas of activity under the 1973 agreement. In the area of fast breeder reactors, the two sides agreed to hold four technical workshops, two each in the U.S. and USSR, to discuss common problems and identify areas where mutually beneficial cooperation might be possible. In the area of nuclear power plant safety, an exchange of visits was agreed upon. The first workshop is planned for December, 1986 by a U.S. team lead by the NRC; and the second by the Soviets sometime in 1987. These exchanges will establish whether there is sufficient interest to initiate an active nuclear safety-related cooperation and exchange program. If the exchanges in Fast Breeder Reactors and Nuclear Power Plant Safety are successful, it is likely that coordinating committees would be formed to encourage the regular interaction of U.S. and Soviet scientists in those two areas.

Japan. Japan is the most important DOE R&D partner, not only in terms of resources committed by each side to cooperative activities, but also in terms of the scope and depth of involvement in each other's energy programs. Five new agreements in the area of coal, fusion, and fission R&D were completed during 1986 in support of DOE efforts to achieve domestic program goals.

DOE signed an implementing arrangement in May, 1986 with the Agency of Industrial Science and Technology of the Ministry of International Trade and Industry in the area of Coal Energy Research and Development. Both countries will work together under the arrangement to accelerate the development of coal energy R&D efforts on the basis of reciprocity and mutual benefit. Specific topics for cooperation include coal liquefaction and gasification technology, materials and components for coal conversion and utilization, and pollution control technology. The first meeting of the Coordinating Committee was held in October, 1986 at the DOE Pittsburgh Energy Technology Center. This was followed by the third Coal Liquefaction Workshop involving the New Energy Development Organization of Japan and the DOE Pittsburgh Energy Technology Center.

DOE expects to conclude an agreement in December, 1986 with the Power Reactor and Nuclear Fuel Development Corporation of Japan in the area of Nuclear Waste Management. This Agreement, along with a similar agreement now under negotiation in waste management with the Japan Atomic Energy Research Institute (JAERI), will manage the relationship between the U.S .and Japan in a technical area critical to the future growth and acceptance of nuclear power in both countries.

DOE signed a fusion-related agreement in 1986 that makes possible the testing of two Japanese-made components in the Fuel Cleanup Systems of the Tritium Systems Test Assembly at Los Alamos National Laboratory. This agreement is the precursor to a cooperative program now being considered in which an entire Japanese-made Fuel Cleanup System would be tested within the next few years.

A Memorandum of Agreement (MOA) for a joint program of physics experiments on advanced nuclear reactor core designs using the Zero Power Plutonium Reactor in Idaho was concluded at the end of 1986 with the Power Reactor and Fuel Development Corporation of Japan. The Japanese will pay for the use of this unique reactor, and the experimental results will be shared equally among participants.

Finally, DOE and Japan agreed in 1986 to exchange information on the decommissioning of nuclear reactors. Facilities under the DOE Civilian Surplus Facilities Management program that will be available for the exchange of information and personnel are the Shippingport Atomic Power Station at Shippingport, Pennsylvania, the West Valley Nuclear Fuel Reprocessing Plant at West Valley, New York, and the Power Burst Facility at the Idaho National Engineering Laboratory at Idaho Falls, Idaho. The Japanese will make available their decommissioning program at the Japan Power Demonstration Reactor and the program for the removal of the reactor system of the Japanese Research Reactor Replacement and Modification Program.

People's Republic of China (PRC). DOE manages three of the protocols under the U.S.-PRC S&T umbrella agreement. A delegation from the Ministry of Coindustry visited U.S. coal research and development facilities under the Fossil Energy Protocol in July, 1986. A joint meeting was held in DOE at Washington to set priorities for coal R&D project cooperation. Both sides agreed to undertake the exchange of technical information in three technologies: coal preparation (i.e., desulfurization and waste stream utilization), coal gasification (i.e., fixed bed and fluidized bed processes and computer modeling), and coal combustion (i.e., atmospheric fluidized bed combustion and materials research).

Annex I of the Nuclear Physics and Magnetic Fusion Protocol was signed in March, 1986 and provided legal protection of intellectual property rights. In November, a U.S. delegation of fusion experts visited Beijing to learn the status of Chinese fusion technology and to discuss and select topics for cooperation.

The High Energy Physics Protocol marked its tenth anniversary of successful cooperation when the 10th Joint Commission meeting was completed in October at Beijing. Construction of the Beijing electron-positron collider (BEPC), a 5.6 gigavolt machine, is expected to be completed in 1988. This project was designated a national key project by Chairman Deng Xioaping when he led the groundbreaking ceremony in 1984, and there has been good progress as a result of successful collaboration among scientists from the Institute of High Energy Physics at Beijing and the Argonne, Brookhaven, Lawrence Berkely, Fermi and Stanford national laboratories. The BEPC project is expected to make an important contribution to world high energy physics research. This cooperation also provides visible evidence of U.S. support for the PRC in advanced technology areas, and is a significant component of good relations.

Korea. The U.S.-Republic of Korea Joint Steering Committee on Nuclear and Other Energy Technologies (JSCNOET) is an interagency committee chaired by the Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs (OES) that oversees cooperative projects in several non-nuclear energy areas. These include advanced coal technologies, solar energy, and building energy conservation. The JSCNOET holds meetings twice a year and supports frequent exchanges of technical experts.

The tenth JSCNOET meeting was held at Washington in mid-1986. Subsequently, the U.S. and Korea signed five-year extensions of three sister laboratory agreements involving the Solar Energy Research Institute, the Pittsburgh Energy Research Institute on coal, and the Argonne National Laboratory on energy conservation.

Canada. DOE signed three agreements with Canada during 1986. The first agreement deals with developing an enhanced oil recovery technique, namely monitoring frontal movements in thermal recovery operations. A coordinated program of laboratory and field experimentation will be conducted to evaluate selected geophysical techniques for determining spatial shape and location of thermal fronts in steam flooding, in situ combustion, and in situ steam processes enhanced by various additives.

DOE also signed a subsidiary agreement for a radioactive waste management technical coordination program in which joint design and planning of experiments and instrumentation development for seven large-scale multicomponent experiments will be pursued. DOE also will deepen Canada's Underground Research Laboratory (URL) from 240 meters to 455 meters. This agreement will benefit greatly the U.S. crystalline repository program as Canada has basically the same type of ground geology as the U.S. The U.S. benefits from the current Canadian URL, and even with the cost of extending the shaft 215 meters, the U.S. will save millions of dollars and several years of research in preparing for the second U.S. repository.

European Community. In July, 1986 DOE and the European Economic Community (EC) signed a MOU on the health and environmental effects of radiation. The MOU focuses on safety areas such as source and dose determination, environmental processes and effects, somatic health effects, and genetic health effects. Both parties' research programs have much in common in this area and joining forces will result in the sharing of crucial technical knowledge and in mutual savings.

United Kingdom (U.K.). DOE entered into two agreements with the U.K. during 1986. The first is for undertaking research in the area of enhanced oil recovery through an inventory of computer models, screening of 27 enhanced oil recovery projects to select the three best-suited for examination, exchange and analysis of information on these three projects, and development of geologic and petrophysical models of reservoirs of the selected projects.

The other agreement, signed in October, is with the U.K. Atomic Energy Authority in the area of radioactive waste management technology. Its scope includes studies of different aspects of waste disposal technology including preparation and packaging of wastes; low-level intermediate, and transuranic waste treatment; and the decommissioning of waste treatment and disposal technologies. The agreement also focuses on public awareness and acceptance, and transportation.

These agreements continue to support the close ties that the U.S. and U.K. have maintained over many years.

France. DOE and the French Commissariat de l'Energie Atomique (CEA) signed a statement of intent several years ago for expanding radioactive waste management cooperation in the area of surface and subsurface disposal and storage of low-level radioactive waste. DOE and CEA also signed an agreement for an exchange of nuclear criticality safety information in order to achieve greater safety in the operation of nuclear facilities and understanding of neutron physics applied to hypothetical accident conditions. This will be accomplished by exchanging and analyzing nuclear excursion data from the CEA's research reactor SILENE and DOE's aqueous research reactor SHEBA.

Cooperative efforts in finding solutions to problems of radioactive waste storage/disposal and of nuclear safety may increase public acceptance of nuclear power and sites for radioactive waste storage and disposal.

Spain. DOE signed an Agreement with the U.S.-Spain Joint Committee for Scientific and Technical Cooperation, and several annexes covering joint energy R&D projects in areas such as high energy physics, renewable energy, underground coal gasification, and engine modeling. An agreement with the Spanish Junta de Energia Nuclear for cooperation in the fields of nuclear energy, renewable energy, energy conservation, high energy physics, and nuclear physics also was concluded. DOE signed an agreement with the Spanish Institute of Geology and Minerals for cooperation in the field of coal technologies and geothermal energy. These agreements were concluded both in support of foreign policy goals of strengthening ties with Spain, and as a means of integrating Spain's R&D efforts with the mainstream of Western science.

Italy. DOE signed an Implementing Agreement in the Field of Direct Liquefaction of Coal with the Italian Ministry of Industry, Commerce and Handicraft in April, 1986. The joint project includes cooperation in carrying out a bench-scale research program for the conversion of coal to liquid hydrocarbons and to develop a conceptual process design based on the research results. DOE also signed with the same Ministry a MOU to exchange energy information for the mutual benefit of both countries. The information includes computer tapes of energy abstracts, energy reports, and other pertinent energy R&D material.

Federal Republic of Germany (FRG). An agreement on research in Liquid Metal Cooled Reactors with the FRG was extended for an additional year.

Norway. DOE began negotiating an overall energy R&D agreement with Norway, initially focusing on enhanced oil recovery technology.

Mexico. DOE signed a geothermal umbrella agreement with Mexico in April, 1986. In addition, DOE is negotiating several annexes under the U.S.-Mexico Cooperative Energy MOU. One annex is on chemical analysis and characterization of heavy crude oil, and another is on high pressure thermodynamic studies of materials important in petroleum processing. These negotiations are nearing completion and the agreements probably will be signed in early 1987.

Venezuela. The DOE umbrella energy R&D agreement with Venezuela currently includes seven active annexes in the areas of heavy crude oil characterization, enhanced oil recovery (EOR), coal technology, oil field subsidence, and training. Three annexes were extended during 1986, including those on coal, oilfield subsidence, and thermal EOR processes.

Israel. An energy R&D cooperation agreement was signed between DOE and the Israel Ministry of Energy in 1984. Under the agreement, a Joint Coordinating Committee (JCC) was set up to identify priorities and coordinate work programs. The JCC held its first meeting in Israel in June, 1985. The second JCC meeting was held in Washington in June, 1986. Dr. Alvin Trivelpiece, Director of DOE Office of Energy Research, headed the U.S. side. There currently are eight projects active under the agreement in the areas of solar energy, biomass, oil shale, and oil geology. DOE signed an annex during 1986 on evaluating micro-algal biomass production, and on absorption cycles and working fluids for solar cooling systems.

At the June, 1986 JCC meeting, the Israeli side tabled a proposal for an ambitious joint program in a demonstration plant for direct combustion of oil shale to produce industrial steam and electricity, and for field testing of solar energy technologies at its new Sede Boker test facility. DOE is reviewing these demonstration-oriented proposals.

DOE and the Israeli Ministry of Science and Development also are negotiating an agreement that will encompass basic science and energy research, and entail setting up a Joint Scientific Committee.

Saudi Arabia. DOE negotiated an extension from January, 1986 to January, 1987 of the SOLERAS solar energy R&D project with Saudi Arabia in order to permit completion of several ongoing projects. Funding for this project totaled $100 million, divided equally between the two governments. Under this program, fundamental research has been conducted in photovoltaic and solar thermal energy, and a solar desalination plant that began operation in 1985 continues to provide valuable data on state-of-the art concepts in this field. SOLERAS also has sponsored basic solar energy research at nine universities in the U.S., and sponsored annual solar energy technology workshops and short university-level courses. Efforts are underway to negotiate a new energy R&D agreement with Saudi Arabia to permit continued cooperation after the SOLERAS agreement expires, an undertaking that would be entirely consistent with U.S. foreign policy goals both in terms of the region and in terms of energy security.

Nuclear Regulatory Commission (NRC)

Bilateral Information Exchange Arrangements

NRC participates in a wide-ranging, mutually beneficial program of information exchange, and cooperative safety and research activities with its counterparts in the international community. Since 1974 when it instituted the program, the NRC has conducted most of its technical information exchange under the aegis of a series of general safety cooperation arrangements it has formally concluded with the regulatory authorities of 21 countries: Belgium, Brazil, the PRC, Denmark, Egypt, Finland, France, FRG, Greece, Israel, Italy, Japan, Korea, Mexico, the Netherlands, the Philippines, Spain, Sweden, Switzerland, the U.K., and Yugoslavia.

These arrangements involve as full and active exchange partners all countries except India that are operating light water reactors of U.S. origin, all countries with reactors of U.S. design under construction, and several countries that at some time in the past seriously have considered making a commitment to U.S. nuclear technology. (With India, NRC has exchanged letters agreeing only to share information on accidents and incidents at nuclear facilities rather than on the full spectrum of safety activities.)

The primary objective of these arangements is to establish a formal channel for communications with foreign nuclear regulatory organizations in order to assure prompt and reciprocal notification of reactor safety problems that could affect both U.S. and foreign nuclear facilities. The agreements also affect identification of possible "precursor events" that warrant further investigation. Since more than 40 percent of the nuclear steam supply systems designed by U.S. firms are located in foreign countries, data from these reactors provide substantial and important input to U.S. operating information data base from which they can, and do, influence U.S. regulatory decisions.

These agreements also provide a framework for bilateral cooperation on nuclear safety, safeguards, waste management, and environmental protection. They serve as a vehicle for the NRC to provide assistance in improving nuclear health and safety practices to developing countries importing U.S. power reactors. They typically are written for a period of five years, but contain provisions for renewal by mutual agreement.

The NRC's bilateral arrangements call for the exchange of all aspects of nuclear safety and regulatory information via cable, telephone, letters, technical reports, and other publications. Exchanges also occur through training courses, seminars, and joint discussions. In some cases, the agreements provide for general cooperation in reactor safety research, and for the long-term assignment of foreign regulatory personnel to the NRC staff or to the NRC programs at the national laboratories for on-the-job training in U.S. regulatory practices and procedures. The arrangements provide in all cases, for the protection of information that the NRC foreign partners have given the NRC in confidence under the condition that it be withheld from public disclosure.

The NRC arrangements with the PRC, the FRG, Japan, and the U.K. all were renewed during FY 1986. Negotiations on the renewals of existing arrangements with Italy, Korea, and Mexico, as well as on a new arrangement with Argentina, are under way.

Bilateral and Multilateral Safety Research Agreements

NRC also has established and maintains a network of general and specific agreements on safety research and cooperation that has grown significantly in both scope and substance over the last few years. NRC currently is involved in over 50 separate research agreements through which it cooperates with 14 countries in ongoing nuclear safety research projects in the U.S. and abroad. These research projects make direct contributions of data and analyses needed to confirm and assess computer codes used in the NRC licensing and regulatory process. Some of this cooperative research involves experiments performed in U.S. facilities with foreign countries making direct cash contributions as high as $5 million each to participate; some of the work involves the foreign country providing the results of complementary or supplementary research it has sponsored in an area of interest or need to the U.S. In other cases, experiments are performed overseas, and the U.S. either contributes instrumentation, test analysis and on-site experts, or makes direct cash contributions to the host program. This kind of cooperation has the effect of maximizing research dollars by coordinating planning, defining priorities, and eliminating duplication of effort.

A good example of this type of foreign support is the series of agreements in the area of thermal hydraulic code assessment that call for the cooperating party to perform costly and time-consuming code assessment calculation. Agreements recently concluded or under negotiation in the thermal hydraulic area provide NRC with over 100 such assessment calculations to be performed over the next three to four years. In addition, France and Italy will make available to NRC experimental data that is obtained in their new multi-million dollar facilities.

Another example is the NRC severe accident and source term research program in which international participation has played a crucial role in maintaining the momemtum of the program in the face of U.S. funding constraints. A consortium of 10 countries presently is contributing personnel, equipment and millions of dollars to this research effort. This year's efforts have resulted in the NRC obtaining commitments to remain in the program from the U.K., Japan, the Netherlands, Italy, Belgium, Korea, Spain, Taiwan and Germany. The NRC in turn has offered these countries access to other related areas of research such as in-vessel and ex-vessel containment analysis and experimental results. Spain is the latest country to join the severe accidents program during this fiscal year, and also is participating in the thermal hydraulic code assessment program and the boiling water reactor (BWR) nuclear plant analyzer program.

The net effect on the NRC regulatory program of this and other international research cooperation is providing the U.S. with over $100 million worth of research.

U.S. Geological Survey (USGS)

Energy resources studies were conducted by USGS in various countries during FY 1986. The two types of studies were technical assistance utilizing funds from other Federal agencies (principally AID), international organizations, or foreign governments, and scientific cooperation through bilateral or multilateral arrangements with foreign counterpart organizations utilizing both Survey-appropriated funds and financial resources made available by the cooperating government or organization.

Pakistan. USGS signed an agreement with AID in late 1985 to conduct a technical assistance program for coal resources assessment in Pakistan. The program is a cooperative endeavor by USGS and the Geological Survey of Pakistan (GSP), and is designed to transfer technology and methodology to Pakistani geoscientists in order to strengthen their capability to independently conduct such assessments in the future.

During 1986, USGS provided a resident-advisor geologist to GSP and 25 man-months of temporary duty (TDY) personnel. Investigations focused on formulation of a National Coal Exploration Plan, initiation of a National Coal Analytical Laboratory System, evaluation and regeneration of the Pakistan National Geodata Center, and design and implementation of a comprehensive exploration and development plan to quantitatively assess the coal resources in southern Sind Province of Pakistan.

Indonesia. The USGS peat commodity specialist worked cooperatively during 1986 with counterpart scientists in the Directorate of Mineral Resources on completing a field study of a peat swamp in Sumatra. A complete peat resource assessment for the region will be completed during 1987, and it will provide guidelines for a national peat inventory, specific detailed studies, and training.

Costa Rica and Honduras. USGS scientists in cooperation with the Los Alamos National Laboratory (LANL) conducted assessments of the geothermal energy potential in Costa Rica with counterparts from the Instituto Costarricense de Electricidad (ICE) and in Honduras with personnel of the National Electric Company (ENEE). Two areas in Costa Rica and one in Honduras are considered to have energy potential and have been recommended for additional exploration.

World Energy Resources Program. USGS revised assessments of crude oil, natural gas, condensate, extra heavy oil, tar sands, and oil shale in the PRC, Pakistan, India, Bangladesh, Burma, Indonesia, southern Africa, Nigeria, the Middle East, west Siberia, the Barents Sea, and Mexico. A workshop entitled Resource Assessment of the Circum-Borneo Area was presented to about 30 representatives from five Southeast Asian countries in Kuala Lumpur, Malaysia. Publications were released on petroleum in the Ordos Basin, the North China Basin, the Songhao Basin in China, and the Baltic Basin; undiscovered petroleum resources of South Asia; and global oil assessments and the search for non-OPEC oil.

Miscellaneous Activities. At the request of geoscience organizations, USGS representatives visit foreign countries to discuss possible cooperative energy activities, to participate in energy meetings, or to conduct workshops. Each activity involves expenditures of only a few thousand dollars and a few man-months of effort. These energy-related activities during 1986 were typified by: (1) discussions on coal/peat projects in Cameroon, Mauritania, Mozambique, Thailand, Indonesia, and Costa Rica; (2) meetings of the Circum-Pacific Energy and Minerals Conference in Singapore; and (3) the Petroleum Resource Assessment Workshop in Malaysia and the Coal Basin Analysis Workshop in India.

Chapter 8 - ENVIRONMENT, NATURAL RESOURCES, AND POPULATION

U.S. involvement in international environmental and natural resource, and population issues has required an increasing effort on the part of the government and private sector. These global issues are viewed with real concern because failure to deal with them satisfactorily will affect the well-being of future generations.

Ozone layer protection is a good example of these issues that only can be effectively addressed globally. This chapter, inter alia, describes the current intense effort by the U.S. to foster an international consensus, and political and economic will, to deal with this issue based on accepted scientific evidence.

In dealing with the international environment and natural resources, the U.S. collaborates closely with other countries and intergovernmental organizations to conserve scarce assets. The U.S. tries to ensure that programs to reverse or ameliorate environmental degradation are well-coordinated and do not duplicate one another by assisting other countries. In view of the seriousness and urgency of many of the problems and budget constraints facing the entire international community, particular attention is paid by the Administration to the need to promote better efficiency, cost-sharing, and allocation of available technical and funding resources. The favorable current results emphasize the need to maximize and continue efforts.

This chapter can provide an understanding of the many important issues currently at play in the international environmental arena, and illustrative examples of U.S. efforts can be found both close by and far afield.

Close to home, an important U.S.-Canada milestone was passed in the effort to deal with transboundary air pollution. President Reagan and Prime Minister Mulroney endorsed the Report on Acid Rain of the Special Envoys in March, 1986. The Report includes a recommendation for initiation of a five-year program in the U.S. for commercial demonstration of clean-coal technologies. In other bilateral undertakings, the U.S. and Canada negotiated an agreement on the transboundary movement of hazardous waste. The U.S. and Canadian environment "ministers" met twice in 1985-1986 to review progress in cleaning up the border area, and to agree on the direction of future environmental cooperation.

Similarly, the U.S. and Mexico made substantial progress toward resolving a number of trans-border environmental pollution issues. Progress is being made in dealing with the Arizona-Sonora border air pollution problem, and work is proceeding in dealing with the problem of sewage from Tijuana reaching the San Diego beach area. In addition, pursuant to the 1983 U.S.-Mexico Border Environmental Agreement signed by President Reagan and President de la Madrid, the U.S. and Mexico have an Annex under active consideration that includes the transboundary movement of hazardous wastes.

More broadly, 1986 was a banner year for international review of safety considerations with respect to the "new" biotechnology, in particular the safe application of recombinant DNA techniques. The OECD Council followed several years of difficult effort by adopting a Recommendation on recombinant DNA safety considerations. This Recommendation was based on an Experts Group report, is expected to foster harmonization of the regulatory infrastructures of both OECD members and other countries, and help avoid barriers to international trade. The U.S. made a significant contribution to this OECD effort, which is recognized as one of the best such efforts in recent years.

Regarding conservation of natural resources, the U.S. continued to participate actively in the U.N. Environment Program (UNEP) and the Man and the Biosphere Program. The U.S. intensified its efforts to promote integration of environmental and natural resource concerns into Multilateral Development Bank (MDB) projects. The U.S.-Panama Joint Commission on the Environment maintained its efforts to focus the attention of both governments on the critical importance of conserving and rehabilitating the Panama Canal watershed.

The U.S. continued its support for the 94-member Convention on International Trade in Endangered Species of Wild Fauna and Flora, chairing the Technical Committee meeting in June and emphasizing conservation of the elephant and rhinoceros. The U.S. Senate ratified U.S. accession to the Convention on Wetlands of International Importance, especially as Waterfowl Habitat, in October 1986. The Convention will provide a framework for sharing U.S. technology and expertise. The U.S. also maintained its support for the World Heritage Convention, assisting 47 member nations in the conservation of unique natural reserves. The U.S. will seek re-election to the World Heritage Committee in 1987.

The Fish and Wildlife Service, National Park Service, U.S. Geological Survey, Bureau of Reclamation, the Bureau of Mines, and the National Oceanic and Atmospheric Administration performed a wide range of multilateral and bilateral cooperative activities in international natural resource conservation, including research, awareness building, training for foreign officials, and technical assistance. Mechanisms for cooperation included numerous bilateral agreements, the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, multilateral agreements, use of U.S.-owned counterpart funds derived from P.L. 480 programs funded through the U.S. Agency for International Development, and funding provided through international organizations and by foreign governments.

Ozone Layer Protection

The U.S. Senate gave its advice and consent to ratification of the Vienna Convention for the Protection of the Ozone Layer on July 24, 1986. The U.S. instrument of ratification was deposited on August 29, 1986. The Convention was signed by the U.S. and 20 other nations and the European Community in March, 1985 after more than three years of intensive negotiations. The Convention creates a framework for international cooperation on research, monitoring, and exchange of information, and provides procedures for developing control measures as needed.

During the negotiations on the Convention, there also was considerable discussion of a possible protocol to control emissions of chlorofluorocarbons (CFCs). CFCs are commerically important chemicals that have the potential of depleting the ozone layer. The ozone layer screens out most harmful solar ultraviolet radiation that would otherwise reach the earth, and its depletion could have significant adverse health, environment, and climatic impacts.

Disagreement among the major CFC producer countries on the optimal control approach resulted in the Vienna Conference's failure to adopt a control protocol. Instead, the Conference passed a resolution calling for further scientific assessment and a series of workshops on the economics of CFC emissions and control, followed by the resumption of protocol negotiations leading to a second Diplomatic Conference in 1987. The past year and a half thus has seen a high level of activity. A major international scientific assessment of the chemical and physical processes affecting the ozone layer was released in January, 1986. This study, entitled "Atmospheric Ozone 1985: Assessment of Our Understanding of the Processes Controlling its Present Distribution and Change" was sponsored by NASA, NOAA, FAA, WMO, UNEP, and other national and international organizations. It is the product of over two years of work by over 150 scientists from around the world.

The first UNEP economics workshop was held in Rome in May, 1986. The purpose of the workshop was to assess the cost and effectiveness of existing CFC regulations, review the technical control options from an engineering perspective, and evaluate short-term and long-term emissions projections for CFCs and other ozone-modifying gases.

In June, 1986, the U.S. government and UNEP sponsored a major international scientific conference on the association between ozone layer modification and global climate change. The conference brought together 300 scientists and policy-makers from 19 countries to review the latest scientific understanding of the health, environmental, and climatic effects of ozone depletion and the global warming trend.

The U.S. hosted the second UNEP economics workshop in September, 1986 in Leesburg, Va. The second workshop assessed various international control strategies in terms of their effectiveness, fairness, ease of implementation, and other factors. The workshop was successful in helping participants move closer to a consensus.

EPA held domestic workshops prior to the international workshops on the same topics, and these were open to the public. Also during the past year, EPA conducted a comprehensive risk assessment on threats to the ozone layer.

U.S.-Canada Environmental Cooperation

The U.S. and Canada continued in 1986 to cooperate on a wide range of transboundary pollution issues. For example, in March, 1986, President Reagan and Prime Minister Mulroney endorsed the Report of the Special Envoys on Acid Rain, as written by Drew Lewis for the U.S., financed by public and private resources, and William Davis for Canada. The two governments are now working to implement the report's recommendations, including: (a) a five-year program in the U.S. for commercial demonstration of clean-coal technologies; (b) a commitment to ongoing cooperative activities, including bilateral consultations and information exchange; and (c) a greater emphasis on carrying out research on transboundary air pollution issues.

EPA, Environment Canada, the New York Department of Environmental Conservation (NYDEC) and the Ontario Ministry of the Environment addressed pollution in the Niagara River by reaching an agreement in principle on a four-part management plan to clean up toxic chemicals in the river. The plan, still under negotiation, would include increased monitoring, point and non-point source control, and improved communications and management.

The two governments also worked together closely in monitoring and cleaning up a mysterious "blob" of toxic chemicals on the Canadian side of the St. Clair River. Canada successfully completed its ten-week, $1 million clean-up in December, 1985.

Finally, the U.S. and Canada negotiated a bilateral agreement on the transboundary movement of hazardous waste. By eliminating the need for prior written consent for each shipment of hazardous waste across the border, the agreement will ensure no interruption in legitimate trade of hazardous waste between the two countries.

The U.S. and Canadian environment ministers met twice in the 1985-1986 period to review progress in cleaning up the border area, and to agree on directions for future environmental cooperation. In addition, technical experts from both countries continued day-to-day, informal contacts through cooperative environmental research programs, and participation on numerous boards and committees of the International Joint Commission (IJC).

U.S.-Mexico Border Environment Agreement

President Reagan and President de la Madrid signed the U.S.-Mexico Border Environment Agreement in 1983. The agreement committed both governments to cooperate fully in the protection and improvement of the environment within 100 kilometers on either side of the border. It designated EPA in the U.S. and the Secretariat of Urban Development and Ecology (SEDUE) in Mexico as the coordinating agencies.

The U.S. and Mexico made substantial progress in 1985-1986 in resolving a number of transboundary pollution problems. In the San Diego-Tijuana border area, for example, where flows of raw sewage from Mexico sometimes pollute coastal areas of southern California, and work by Mexico is underway to construct wastewater treatment facilities for Tijuana.

The two governments also are working to control air pollution from copper smelters along the Arizona-Sonora border. The Phelps Dodge Corporation in the U.S. is committed to closing down the Douglas smelter in Arizona by January 15, 1987. In Mexico, Mexicana de Cobre has signed a contract with a Canadian firm to build a sulfuric acid plant at the Nacozari smelter by January, 1988. The two governments also have discussed an Annex to the 1983 Border Environment Agreement to formalize and expand on commitments for control.

The U.S. and Mexico will continue reviewing progress in protecting the border environment at annual meetings of the U.S. and Mexico National Coordinators under the 1983 Agreement. Additional problem areas to be discussed in upcoming years will include: illegal shipments of hazardous waste across the border, air pollution problems in the San Diego-Tijuana and El Paso-Juarez air basins and water pollution problems in the New River, Rio Grande, and other border wastes. The two governments also will discuss Mexico's proposed Annex on the transboundary movement of hazardous waste.

Biotechnology

Several significant milestones were passed in FY 1986 in the area of biotechnology. Important goals of the U.S. in this field are the protection of health and environment, and avoidance of unnecessary barriers to international trade.

The U.S. published in July the Federal Register Notice (FRN) entitled "Coordinated Framework for Regulation of Biotechnology: Announcement of Policy and Notice for Public Comment." This FRN incorporates a policy statement in its International Aspect section which points out that the U.S. seeks to promote international scientific cooperation and understanding of scientific considerations in biotechnology and to reduce barriers to international trade. It also states that U.S. agencies publishing separate policy statements as part of the FRN are committed to this policy. The FRN states that the broad goals set forth in the recent report of the OECD Ad Hoc Group of Government Experts on recombinant DNA safety considerations were taken into account in developing the FRN, and the FRN presents an appropriate summary. The report of the OECD Experts Group was accepted by all OECD member countries, including the U.S., earlier this year in the OECD Committee on Scientific and Technological Policy.

The OECD Council adopted a formal Recommendation on recombinant DNA safety considerations in July, 1986. This OECD Recommendation also is based on the Experts Group report. The U.S. provided high-level participation in developing and obtaining acceptance of the Experts Group report and the OECD Council Recommendation during 1985 and 1986 and is pleased its representatives had the opportunity to work with their counterparts of other governments. This work is recognized as one of the best efforts by OECD.

Acid Rain

Transboundary air pollution is a major problem in many countries, especially in North America and Europe, and concern is growing about its present and potential effects on lakes, forests, crops, buildings, and human health. Significant research programs are underway in several countries, indicating that both wet and dry acid deposition can be caused by a number of pollutants, including sulfur dioxide, nitrogen oxides, and volatile organic compounds.

Acid rain in North America continues to be a major source of concern to both the U.S. and Canada. The two governments agree that acid rain is a serious environmental issue, and a limited amount of damage to certain sensitive surface waters has occurred. Assessments vary as to the present degree and cause of this damage, and as to the potential for additional damage. Canada announced in March, 1985 a major new program of emissions reductions for sulfur dioxide and nitrogen oxide, with a goal of reducing allowable limits of sulfur dioxide by 50 percent by 1994. Actual reductions would be smaller. Auto standards for nitrogen oxide will be tightened to equal current U.S. standards by the 1988 model year.

The U.S. operates the world's largest program to control air pollutants. In the past decade or so, upwards of $150 billion has been expanded in the U.S. to achieve clean air. This program has resulted in a significant 23 percent reduction in sulfur dioxide emissions, and a leveling of nitrogen oxide emissions. The Administration, therefore, is reluctant to undertake the enormous cost of additional emissions reductions targeted specifically against acid rain until fundamental scientific uncertainties are resolved. Meanwhile, the U.S. has committed large sums of money to study the effects of sulfur dioxide and nitrogen oxide on air quality in North America, and to determine the extent to which they contribute to acid rain.

Efforts to resolve the acid rain issue in North America have been underway for a number of years. President Reagan and Prime Minister Mulroney named Special Envoys, Drew Lewis from the U.S. and William Davis from Canada, in March 1985 to prepare a report on transboundary air pollution. The Special Envoys' Report was issued in January, 1986 and fully endorsed by both Heads of State at their ensuing March 1986 Summit. Currently, both countries are working actively to implement the Envoys' joint recommendations. The two governments have established a cooperative bilateral mechanism to coordinate implementation.

The U.S. government has been expanding its National Acid Precipitation Assessment Program (NAPAP), a ten-year interagency domestic research effort that began in 1980. The FY 1986 budget for NAPAP amounted to approximately $85 million, and the Administration has presented Congress a FY 1987 budget proposal at approximately the same level. One element of NAPAP is coordination with related research activities in other countries. Several workshops were convened in 1986 for scientists from U.S., Canada, and Europe to develop plans for a large-scale field data collection exercise. This would provide a data base for evaluating the advanced regional "source-receptor" models currently being developed in the U.S., Canada, and Europe.

On the multilateral front, the U.S. is an active member of the U.N. Economic Commission for Europe (ECE) Convention on Long-Range Transboundary Air Pollution (LRTAP), which entered into force in 1983. A 1985 protocol to the LRTAP Convention requires that signatories reduce their sulfur dioxide emissions or related transboundary fluxes by at least 30 percent by 1993, using 1980 as the base year. Twenty-one parties to the Convention have signed the protocol. The U.S. is unable to sign because the protocol does not provide credit for U.S. emissions reduction prior to 1980. Nevertheless, the U.S. supports other countries acceding to the protocol in order to reduce transboundary air pollution in their areas.

The U.S. has participated in an ECE Working Group since 1985, that has been considering a possible protocol to the LRTAP Convention for controlling nitrogen oxide emissions. The U.S. has considerable experience in the field of nitrogen oxide technology and controls, and supports greater international harmonization of nitrogen oxide standards. The LRTAP Executive Body will consider a Working Group recommendation on elaboration of the elements of a nitrogen oxide control protocol.

Another important activity under the LRTAP Convention is the Cooperative Program for Monitoring and Evaluation of the Long-range Transmission for Air Pollutants in Europe (EMEP). The U.S., Canada, and other countries continue to cooperate closely with EMEP because of the importance of developing more accurate data on transboundary air pollutants. The U.S. is making a voluntary contribution of $40,000 to EMEP during the 1984 through 1987 period.

London Dumping Convention

The 1972 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter (i.e., the London Dumping Convention, or LDC) is the major international legal instrument for the regulation of dumping wastes in the ocean. The U.S. ratified the LDC on April 29, 1975; the agreement entered into force on August 30, 1975.

The Tenth Consultative Meeting of Contracting Parties to the LDC was held in October, 1986 in London, and it acted on a wide range of environmental issues. It adopted guidelines on disposal at sea of dredged material; broadened the mandate of the Scientific Group on Dumping, instructing it to compare land and sea options and to review and recommend changes in the structure of LDC controls; adopted a resolution on export of wastes for disposal at sea; launched work on studies and assessments of disposal at sea of radioactive waste called for by the previous meeting's resolution on this subject; and set up a working group of legal experts to consider both the relationship between LDC and the U.N. Convention on the Law of the Sea and issues related to compensation and liability for harm from dumping. It also made note of the effects of disposing persistent plastics in the marine environment, and the contribution of Contracting Parties, especially the U.S., to the reduction of such disposal.

The Dredged Material guidelines recognize the special character of dredged spoils, and expand and consolidate earlier guidance, and culminating several years of work by the U.S. Army Corps of Engineers. The final draft was prepared jointly with the Oslo Commission. A resolution on transboundary movements of wastes for disposal at sea complements other U.S. efforts to control export for disposal of toxic and hazardous wastes.

The meeting established an intergovernmental panel on radioactive waste issues to: (a) assess political, legal, economic, and social aspects of disposal at sea of radioactive wastes; (b) compare land and sea disposal; and (c) assess the burden of proving the safety of such dumping. The meeting also drafted a questionnaire to elicit comments and information on relevant national policies, practices, and experience.

In view of successful completion of several tasks, and to free funds for the radioactive waste studies, the meeting voted to delay its next session to the autumn of 1988, and to give its October, 1987 slot on the International Maritime Organization (IMO) Calendar to the radwaste panel.

Radioactive Waste Dumping

Disposal at sea of radioactive wastes, except that with high-level radioactivity as defined by the International Atomic Energy Agency (IAEA) is permitted under LDC. However, there is a non-binding LDC resolution calling for suspension of such disposal pending a series of studies. The U.S. is cooperating in a study of political, legal, economic, and social aspects pursuant to this resolution. Under current U.S. law, dumping in the ocean of radioactive waste is subject to a radioactive material disposal impact assessment, and approval by a joint resolution of Congress that is signed by the President. IAEA is providing technical studies for LDC; its revised definition of high-level radioactive wastes was published as Safety Series 78 in September, 1986. The OECD's Nuclear Energy Agency (NEA) monitors the northeast Atlantic dumpsite. Also, the NEA is coordinating an international, long-term study of the feasibility of sub-seabed emplacement of high-level radioactive wastes. DOE has cooperated in this study, but has reduced funding and will suspend its participation after FY 1987 for budgetary reasons.

Transboundary Movement of Hazardous Waste

The issue of hazardous waste and the need for its good management have continued to receive much public and international attention in FY 1986 as a major environmental and health issue. Considerable attention also has been given to the issue of transboundary movement of hazardous waste, and many countries have joined with the U.S. by participating in several ongoing projects in international organizations such as OECD and the United Nations Environment Program (UNEP).

EPA promulgated new regulations in 1986 on the export of hazardous waste. Under the new regulations that take effect on November 8, 1986, EPA will require prior notice of the exported material with more information than its previous notification system, and the receiving or transit country must submit written consent prior the shipment(s) taking place. A copy of the country's consent must accompany the shipment, which will give the U.S. an enforcement mechanism it presently does not possess. There also is a provision in the regulations that allows for bilateral agreements that can simplify the notification and eliminate the prior written consent requirement. This mechanism will ensure that the regulations do not hamper legitimate trade in hazardous waste across national frontiers. The U.S. expects to conclude its first bilateral agreement with Canada, since there is a significant amount of hazardous waste crossing the U.S.-Canadian border in both directions.

The U.S. has played an active and constructive role in hazardous waste activities of the OECD and UNEP, and has a major role in developing a binding OECD convention by 1987 on the transboundary movement of hazardous waste. The contents of this convention will be compatible with the new U.S. export laws and regulations. The U.S. also has contributed significantly to the development of a body of UNEP guidelines for good management of hazardous waste. These are especially important because they assist less industrialized nations in developing their own programs for harzardous waste management. The U.S. expects to participate in some follow-up technical workshops, sharing its experience and expertise with nations that are just beginning to develop hazardous waste management programs.

Other Multilateral Activities

OECD Environment Committee

The OECD Environment Committee and its expert groups continued project work from 1985 this year in several areas of significant interest to the U.S., including long-range transport of photochemical oxidants, motor vehicle pollution control, development of an OECD system for notification and tracking of international shipments of hazardous waste, an OECD technical paper on biologic testing of wastewater effluents, a comprehensive OECD program on chemicals and the environment, and work on a core set of internationally comparable environmental data. The Committee completed the design of two significant new projects on the integration of OECD countries' agricultural and environmental policies, and the comprehensive management and protection of water resources. The Committee also decided to plan a special OECD meeting on global climate issues to be convened in 1988.

Chemicals and Pesticides

There is widespread concern about adverse effects on human health and the environment that might result from accidents or unsafe practices with hazardous or toxic chemicals and pesticides (e.g., PCBs and DDT). Protection of health and the environment requires development of appropriate chemical and pesticide regulations. Differences in national regulations among countries can affect international trade. To avoid potential trade barriers, international harmonization of national regulations is useful.

The U.S. had an extensive regulatory infrastructure prior to the more recent activity directed at international harmonization. It included export notification programs with regard to chemicals and pesticides regulated (i.e., banned, restricted, or not registered) under the Toxic Substances Control Act (TSCA) and the Federal Fungicide, Insecticide, and Rodenticide Act (FIFRA).

The U.S. as in the past, is in a particularly useful position in terms of contributing experience to ongoing harmonization activities. Participation internationally in turn provides feedback and ideas of use to the U.S. domestic program. The U.S. supports the principle of information exchange on national control actions, and actively undertakes to share data and experience, for example on chemical and pesticide assessment, regulation, and labeling.

OECD Chemicals Program

The Chemicals Program of OECD that started in 1971 is a good example of an ongoing and successful international effort. OECD often uses a lead country concept to direct new initiatives in order to conserve scarce financial and personnel resources. This permits countries to either participate at the start, or to join later as resources allow. The U.S. is the lead country for an OECD initiative on existing chemicals, the Switchboard Program. Switchboard is a referral system designed to improve access by member countries to unpublished information held in other member countries. Switchboard started in 1985, and has been very successful. When the pilot phase concludes in mid-1987, consideration will be given to expanding participation beyond the original group of countries.

Much of the activity in the Chemicals Program to date has been devoted to new chemicals. Current activities concern hazard assessment, good laboratory practice, confidentiality of data and other areas. Member countries now agree, however, that existing chemicals need increased attention, and consideration is being given to the scope of such work. The current mandate for the OECD Chemicals Program expires at the end of 1987. The U.S. participated actively in preparations for the Third OECD High-Level Meeting (HLM III) of the Chemicals Group at the ministerial level scheduled for March 17-19, 1987. HLM III will set the course of the OECD Chemicals Program into the early 1990s, and "existing chemicals" will play a major role.

Certain U.N. Activities

The U.S. also participates in several U.N. programs related to toxic substances and the environments. The U.S. participates in this area with WHO, UNEP, the U.N. International Program on Chemical Safety (IPCS), the U.N. Codex Alimentarius, and the U.N. Food and Agriculture Organization (FAO).

The U.S. through EPA and FDA continued cooperation with Sweden, Yugoslavia, Japan, Brazil, and the People's Republic of China during 1986, in a GEMS pilot project jointly sponsored by WHO and UNEP on improving methods for monitoring human exposure to toxic pollutants. This effort is addressing the role of air, drinking water, and food as pathways for human exposure to organochlorine compounds, metals, and other toxics pollutant.

The U.S. commenced preparations in 1986 for a UNEP Working Group meeting scheduled for February 4-10, 1987. The purpose of the meeting is to develop in more detail a proposed set of voluntary guidelines dealing with the exchange of information on harmful chemicals in international trade. The U.S. already has taken a positive position on the proposal. The Provisional

Notification Scheme (PNS) that already exists and is administered by the International Register of Potentially Toxic Chemicals (IRPTC), is a sub-set of these more extensive draft guidelines. The PNS is working well.

IPCS is sponsored jointly by WHO, UNEP, and the International Labor Organization (ILO), and continues to serve as a principal U.N. forum for evaluating toxicity of high priority TSCA and FIFRA related chemicals, and for improving methodologies for toxicity testing and risk assessment. IPCS is expanding efforts on emergency preparedness and response to chemical emergencies. IPCS is supported by WHO, UNEP, and ILO, and from financial and in-kind contributions from a small group of U.N. member countries.

The U.S. also maintains active participation on the Codex Alimentarius Commission of WHO and FAO, and sets standards for pesticide residues and food additives. In this organization, EPA is engaged in furthering international pesticide tolerance harmonization efforts.

The U.S. participated over the past several years under FAO auspices in the development of a voluntary International Code of Conduct on the Distribution and Use of Pesticides. FAO particularly is concerned with the difficulties associated with the extensive use of pesticides in agriculture. The Code was adopted by the U.S. and other countries in late 1985 and distributed in 1986. An objective of the FAO Code is to describe the shared responsibility of many segments of society for the safer use of pesticides, including governments, the pesticide industry, international institutions, manufacturers, and traders.

Economic Commission for Europe (ECE)

The U.S. is a Contracting Party to the Long-Range Transboundary Air Pollution Convention of ECE that was opened for signature in 1979. The Executive Body of the Convention met for the third time in July, 1985 and agreed to establish an *ad hoc* Working Group to "prepare the necessary substantiation for appropriate internationally agreed measures and proposals aimed at the reduction of nitrogen oxides".

The Working Group met three times in 1985 and 1986, and prepared a report to the Executive Body recommending the development of proposals for a nitrogen oxide protocol to the Convention. The Executive Body will consider this report in November, 1986.

NATO Committee on the Challenges of Modern Society (CCMS)

The U.S. has continued to maintain an active presence in CCMS by supporting new pilot studies of special environmental interest. The EPA Office of International Activities directs U.S. participation by federal, state, and local agencies, and by the private sector.

At the 1986 CCMS Fall Plenary, the U.S. has introduced a proposal for a new pilot study on "The Demonstration of Remedial Action Technologies for Contaminated Land and Groundwater". The Federal Republic of Germany (FRG) and the Netherlands will serve as study co-pilots. The purpose of the study is to test and evaluate new technologies and existing treatment systems. Methods of on-site treatment of contaminated sites by detoxifying, neutralizing, degrading, and immobilizing, or otherwise rendering harmless specific contaminants, will be examined. Scientific, technical, and economic data on field demonstrations, and current national practice, will be shared by participating countries.

The U.S. also plans to participate in a new French-led pilot study on "Assessment of Risk of Accidental Pollution from the Shipping of Dangerous Products". This new study will complement work currently underway in the U.S. on spill prevention, response, and environmental effects. In addition, the U.S. will participate in a new study led by by the FRG on "Conservation of Brick Buildings".

The U.S. has supported existing studies in the past year in a variety of areas, including the health and medical aspects of disaster preparedness, aircraft noise abatement, risk assessment of toxic chemicals, dioxin information exchange, and the conservation of historic monuments. The EPA hosted a CCMS workshop in October, 1986 on the multimedia aspects of environmental contamination.

Other Bilateral Cooperative Environmental Arrangements

People's Republic of China (PRC)

Progress continues on all existing projects of the US-PRC Environmental Protection Protocol. Preliminary findings of the joint lung cancer-coal combustion study have been submitted for publication. Chinese engineers and their EPA colleagues have gone far in refining low-cost land application techniques for treatment of industrial wastewater. Several Chinese scientists were trained in the U.S. in toxicity test methods for assessing water quality conditions; they will apply these approaches in China under conditions which will provide valuable data to both sides.

Two Chinese delegations visited a number of EPA laboratories to initiate consideration of new joint research activities on aspects of water quality and environmental monitoring. Prospects for Chinese participation in the Global Trends Network for acid deposition monitoring remain dim as a result of China's unwillingness to adhere to established procedures regarding sample transfer and quality assurance. Differing views on cooperation in the realm of environmental management, however, are approaching resolution and an initial exchange of specialists is anticipated in FY 1987.

European Community (EC)

Consultations on environmental issues normally are held on a yearly basis under a 1974 agreement between the U.S. government and the EC Commission. However, during 1986 the position of Director-General of DG XI, the environmental directorate, remained vacant and no consultations were held. A Director-General was named in late 1986, and it is expected that the consultations will take place at Washington in early 1987.

The last meeting took place in Brussels in February, 1985. Topics which were discussed then remain at the forefront of common interest, and include: the ozone layer, chemicals (e.g., existing chemicals, biotechnology, hazard assessment, formaldehyde, and EPA's proposed rule for several exemptions to Premanufacturing Notification), air pollution (e.g., acid rain, unleaded gasoline, toxic air pollutants, motor vehicle emissions), hazardous waste (e.g., notification system, waste management, RCRA reauthorization), and issues of mutual interest pending before international organizations. Information on these and other environmental problems is exchanged regularly so that the U.S. and the EC countries are aware of major environmental developments that may affect political and economic relationships.

Federal Republic of Germany (FRG)

Bilateral cooperation with environmental authorities and scientists in the FRG provides significant benefit to the EPA domestic program. The two countries share common concerns and commitments, and benefit through exchange of information and experience on their approaches to the solution of major environmental problems.

Current work under the U.S.-FRG Agreement on environmental cooperation focuses on acid deposition and its ecologic effects, hazardous waste management, innovative regulatory approaches, source controls for air pollution, radiation protection, groundwater protection, and other topics. Specialists from both sides visit each other's laboratories and field sites to continue cooperative research on forest damages, a major concern in the FRG and of growing interest in this country. At their Coordinators' Meeting in November, 1986, EPA Associate Administrator Green and Ministerialdirektor Herfeldt of the German Federal Ministry of Environment, Nature Protection, and Reactor Safety endorsed ongoing work and agreed on new topics for inclusion in the program.

Under the Agreement, EPA initiated a personnel exchange in order to further the professional sharing of experience. Five EPA personnel worked with their colleagues in German organizations during 1985-86, for up to six months on hazardous waste management and enforcement techniques, control of automotive air pollution, and legal elements for environmental case development. The German side has identified candidates who will be placed in EPA offices during 1987. The U.S. also had significant exchanges with the FRG through multilateral fora such as OECD, ECE, and the NATO CCMS. Within CCMS, the U.S. and FRG lead a major effort on control of dioxins. The German Marshall Fund of the U.S. has promoted and assisted in the exchange of specialists and meetings on development of innovative economic instruments to encourage voluntary compliance with pollution regulations.

Japan

The U.S.-Japan Agreement on Cooperation in the Field of Environment was signed in 1975, and extended for five years in 1980 and again in 1985. EPA and the Japanese Environment Agency exercise general oversight of the Agreement and its 15 projects that successfully promote the exchange of new technologies, practical experience, and data on a broad array of priority environmental issues. Benefits derived by both sides from these exchanges are evaluated at the Joint Planning and Coordinating Committee Meeting (JCCM) normally held every 12 to 18 months, alternately in the U.S. and Japan. Wastewater treatment, air pollution control, solid and hazardous waste management, toxic substances, environmental impact assessment, and food chemistry are the subjects of current projects.

Poland

EPA has initiated discussions with Polish counterparts on mutual R&D interests in the realm of air and water pollution control technologies.

USSR

Overall activity under the U.S.-USSR Environmental Agreement increased slightly in FY 1986 in the wake of the Ninth Environmental Joint Meeting held in Moscow in November, 1985. Eight inactive projects were dropped, and four new projects were added on problems of environmental education and training, groundwater quality, hazardous waste management, and low-waste non-waste technologies. Productive exchanges of specialists took place in a number of ongoing projects, including the influence of environmental changes on climate, earthquake prediction, air pollution modeling, marine mammal ecology, water quality management and research, and costal marine pollution effect. Prospects are good for significant bilateral research on environmental effects of long-term climate change, and depletion of stratospheric ozone.

The Netherlands

Cooperation between the U.S. and the Netherlands takes place under a Memorandum of Understanding (MOU) between EPA and the Dutch Ministry of Housing, Physical Planning, and Environment.

Ongoing cooperation is focused on innovative cross-media, results-oriented environmental management, hazardous waste management and emergency preparedness, water quality protection, health effects, acid deposition, and other priority topics. EPA initiated a personnel exchange during 1986, providing an expert from the Chicago Regional Office of EPA to work in the Netherlands for four months on water enforcement matters. The Dutch reciprocated, sending one of their experts to Washington and Chicago for work on enforcement data systems for air, water, and hazardous waste. Other exchanges are foreseen as the program progresses.

Yugoslavia

Productive collaboration on problems of environmental research proceeds through EPA participation in the U.S.-Yugoslavia Joint Board for Scientific and Technological Cooperation. Fourteen projects are underway on such varied topics as automobile emissions control, marine pollution modeling, human exposure assessment, and hazardous waste management.

Environment and Natural Resources

United Nations Environment Program (UNEP)

UNEP was established pursuant to recommendations of the 1972 Stockholm Conference on the Human Environment, as adopted in a U.N. General Assembly resolution of the same year. Its basic mission is to catalyze and coordinate international efforts, especially within the U.N. system, and to address environmental and natural resource issues of common concern. With headquarters in Nairobi, UNEP has developed into the primary international forum for interaction on these issues between industrialized and developing countries.

During FY 1986 UNEP continued to carry out a wide range of program activities, assigning priorities in broad accord with U.S. interests. The U.S. attaches particular importance to the following activities:

1. The Global Environmental Monitoring System (GEMS) which assembles, analyzes, and disseminates data on global conditions and trends in major environmental media. Additional progress was achieved in developing the Global Resource Information Database (GRID), a GEMS component receiving substantial U.S. (*i.e.*, NASA) support through expert personnel and advanced technology including space applications.

2. The Oceans and Coastal Areas (formerly Regional Seas) Program which promotes environmental protection and natural resource management agreements among countries bordering specified ocean regions. Principal U.S. attention in FY 1986 was devoted to further implementation of the Action Plan for the Wider Caribbean Region (defined to include Puerto Rico, the U.S. Virgin Islands, and the U.S. Gulf Coast), along with the associated Cartagena Convention, and to completing negotiation of a similar regional agreement for the South Pacific.

3. Current activities of the Environmental Law Program (ELP) which include developing a protocol to the 1985 Ozone Layer Convention on controlling emissions of ozone-depleting chlorofluorocarbons (CFCs), providing guidelines for notification of international transfers of hazardous substances, and instituting international principles and guidelines on environmental impact assessment.

UNEP operates under oversight and guidance of a Governing Council of 58 member governments including the U.S. The next session of the Governing Council of UNEP is scheduled for June, 1987. Meanwhile, communication of views and interaction between governments and UNEP is being maintained effectively through a standing committee of governmental Permanent representatives to UNEP. The U.S. permanent representative has taken an active role on the Committee.

The U.S. in FY 1986 remained the largest contributor to the voluntary environment fund that finances UNEP program activities. The U.S. contribution of $8.6 million represented more than a third of the total $23.4 million pledged for the year as of May 31, 1986. In October, Congress appropriated $6.8 million, the amount requested by the Administration, for the FY 1987 U.S. contribution.

Continued support for UNEP is consistent with broad U.S. international environmental policy. Many environmental and natural resource problems transcend national borders and some are of global dimensions; UNEP programs further our strong interest in seeing that all concerned countries are informed as fully as possible about these problems, and share appropriately in international efforts to address them. In view of the scope of U.S. domestic environmental protection measures, it is considered in the economic as well as social interest to promote comparable steps by other countries. The catalytic function of UNEP contributes to such a process.

U.S. Man and the Biosphere Program

The Man and the Biosphere Program (MAB) with strong U.S. support was launched in 1970 at the UNESCO General Conference as the successor to the International Biological Program. In 1972, the Department of State established a U.S. National Committee for MAB that has guided the U.S. program and participation. The U.S. is one of 105 nations that have established a MAB Program.

MAB is an intergovernmental program that integrates interdisciplinary programs of scientific inquiry and research, analysis, training, and information exchanges to find new approaches to managing human interactions with an array of ecosystems (e.g., tropical forests, arid lands, islands, polar regions). MAB is known best for its international network of "Biosphere Reserves" some protected samples of the world's major ecosystems for research and monitoring purposes with the U.S. having 45 of 265 sites worldwide.

The Secretariat for U.S. MAB is located within the Office of Ecology and Natural Resources of the Bureau of Oceans and International Environmental and Scientific Affairs (OES) of the Department of State, and provides the staff, overhead costs, facilities, and office space. U.S. MAB reimburses cooperating scientists for directly incurred expenses, but does not pay the salaries of the researchers involved. U.S. MAB received and allocated $525,000 in FY 1986. Agency contributions from the Department of State, DOI, National Park Service, USDA, Forest Service, NASA, Peace Corps to U.S. MAB were the third largest amount in the history of the program. Two new agencies joined U.S. MAB in FY 1986: the Peace Corps to participate in the investigation and design of tropical reforestation programs; and the Smithsonian Institution, launching a new program in biologic diversity especially in third world countries. U.S. MAB also received funds from the International Conventions and Scientific Organizations Contributions account of the 1986 Foreign Assistance Act. These funds supported international scientific activities of the U.S. program.

Approximately 70 percent of U.S. MAB funds were used to support international components of the program. A U.S. scientist was selected and stationed within the Secretariat of the UNESCO MAB Program in Paris. Support also was given to two international advisory panels to enhance the scientific quality of the international program, and to implement the International Action Plan for Biosphere Reserves. These U.S. MAB funds also attracted the allocation of resources by several international organizations such as UNESCO, the U.N. Conference on Trade and Development (UNCTAD), and the UNEP. These organizations provided financial as well as in-kind support to the U.S. MAB initiated and hosted global workshop on environmental management and development problems of small islands. The MAB Program of Canada and the Government of Australia also contributed financial resources and in-kind support for this workshop.

Additional major activities of U.S. MAB in FY 1986 included the co-sponsorship with NOAA of an international seminar on management of protected marine areas; it was partly funded by private sector contributions and non-governmental environmental organizations and drew participants from Asia, Africa, Europe and Australia. U.S. MAB and NOAA are continuing to collaborate on follow-up activities to the seminar, including the production of a newsletter to keep managers of protected marine areas in communication with legal, institutional, and international developments. The U.S. MAB Directorate on Biosphere Reserves, in collaboration with the International Union for the Conservation of Nature and Natural Resources (IUCN), initiated an inventory of macro-reserves in the U.S. This Directorate also is preparing several publications for the education of the general public on the need for conserving biologic diversity. U.S. MAB continued to emphasize human relationships with the tropical forests through projects on tropical ecosystem reconstruction and restoration, and the publication of summary results of more than 20 U.S. MAB-funded research studies on tropical forestry.

U.S. MAB directly benefits the Government by providing access to the scientific community for information, research, and advice in support of a broad array of environmental policies. U.S. MAB research projects help provide new insights and information for the Department of State and other participating federal agencies. The international linkages of the MAB program also provide U.S. institutions access to scientists, scientific institutions, and networks of 104 other nations.

Multilateral Development Banks and the Environment

Critical attention continues to be given by environmental organizations and key Congressional committees to the impact of the activities of the multilateral development banks (MDBs) on the environment and natural resource base in developing countries. The most recent in a series of Congressional hearings on the subject was held May 1, 1986 by Senator Kasten's Appropriations Subcommittee. The hearings have focused both on the general environmental policies and broad impacts of MDBs, and on particular projects or programs that jeopardize the fast dwindling critical tropical forest resources, such as the Amazonian rain forests.

The concern about potential environmental harm from MDB projects is based on the conviction, derived from scientific evidence and economic analysis, that truly sustainable development can be built only on a foundation of careful resource management that integrates environmental considerations into overall development planning. Toward this end, the Congress has set forth in various recommendations a series of reform objectives it wants the Executive Branch to pursue with MDBs.

The Department of State is actively supporting the Treasury Department, the lead agency on matters of U.S. policy toward MDBs, in reviewing MDB projects for their environmental implications. AID will lend additional assistance in the months ahead to this effort. The objective is to identify and affect changes in environmentally harmful projects and more generally, to influence bank management in attempts to assure that their policies consistently promote integration of environmental issues into the project development process.

From a U.S. government perspective, this effort constitutes a relatively limited demand on resources. A small number of officials in Treasury, State, and AID review MDB projects and policies for their environmental implications, and pursue with bank management the effort described in this section. While less effort is expended by other MDB-donor governments, the U.S. is receiving increasing support from developed countries to bring about meaningful improvement in the environmental policies of the banks. The U.S. also is engaging a number of key borrower members in the hopes of getting them to focus carefully on the environmental and natural resource implications of development projects in their countries.

It is hard to chart progress in this effort, but there definitely is forward action. There are signs of significant internal change underway within the MDBs. Good development economics points in the same direction. Development activities that are based on sound and careful resource and environmental management are more likely to stand the test of time, and in the long run be less costly than ill-conceived or poorly implemented projects that later must be revised, repaired, or even abandoned. Thus, the benefit/cost ratio of U.S. effort currently underway should be immensely positive in the long run.

U.S.-Panama Joint Commission on the Environment

The U.S.-Panama Joint Commission on the Environment (JCE) was established under Article VI of the Panama Canal Treaty of 1977, and it continued efforts to focus the attention of both Governments on the critical importance of conserving and rehabilitating the Canal watershed. The Commission is comprised of three Panamanian and three U.S. Commissioners. JCE pursued its objectives discussions during January and May, 1986 with representatives of the Panamanian and U.S. governments, Panama Canal Commission, Canal Alternatives Study Commission, and private Panamanian conservation organizations.

A number of previous JCE recommendations have been incorporated into the AID Panama planned Natural Resources Management Project. An investment of $50 million, including Panamanian counterpart contributions will be made over a multi-year period for rehabilitation and preservation of Panama's watersheds through reforestation, management and protection of unspoiled areas, and environmental education. Twenty-five percent of the funds would be directed specifically toward the Canal watershed. The JCE reaffirmed its support for the project, but implementation is conditional upon enactment *of Panamanian legislation granting autonomy to the Institute of* Renewable Natural Resources (RENARE), the agency implementing the project.

Although statistics indicate that the Government of Panama is enforcing its laws that regulate cutting and clearing of forests in the Canal watershed, the Commission encouraged the Panamanian Defense Force and RENARE to devote more resources to enforcement. The JCE noted that the socioeconomic problems surrounding the increasing influx of subsistence farmers into the area must be addressed much better in order to stem the serious deforestation due to slash and burn farming.

The JCE endorsed efforts by AID, the World Wildlife Fund, and the Nature Conservancy to develop and strengthen private sector non-governmental conservation organizations in Panama, emphasizing the need for enhanced environmental education. The Commission worked with the Panamanian National Commission for the Environment and other agencies to ensure that environmentally sound operations standards are applied to sanitary landfills used by Panama City and the Panama Canal Commission, as well as a commercial ship-breaking facility on Telfer's Island.

Future activities of the JCE will include consideration of environmental issues evolving from the work of the tripartite (i.e., U.S., Panama and Japan) Canal Alternatives Study Commission, and from the proposed widening of the Gaillard Cut.

International Wildlife Conservation

Convention on International Trade in Endangered Species (CITES). The U.S. Fish and Wildlife Service (FWS) is the principal agency involved in international wildlife conservation. It implements the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) through its U.S. Management Authority and Scientific Authority. The Convention was concluded in 1973 at Washington largely through U.S. initiative. More than 90 nations now are Parties to it.

The U.S. contributed $172,000 to the CITES General Fund in FY 1986. The U.S., through the FWS, also provided $35,000 to CITES in 1986 for the study of Caiman crocodiles and funded the travel of several delegates from developing countries to the CITES Technical Committee (TEC) Meeting in June. The U.S. chaired the TEC and sent a seven-person delegation to the meeting. The FWS and other agencies continued to expend between $2.5 and $3.0 million (annual rate) on U.S. implementation and enforcement of CITES in FY 1986.

A number of important U.S. goals have been achieved through CITES. These include identification and protection of over-exploited species, establishment of an international body for controlling trade in wild fauna and flora, as well as scientific and management authorities in most member countries, and focusing the attention of other countries on the need to conserve the world's living heritage. CITES currently is devoting special efforts to improving compliance with CITES controls, examining the biological impact of commercial trade on highly-traded species, (e.g., certain parrots), and conserving the elephant, rhinoceros, Caiman crocodiles, and other endangered species.

Other Conventions and Activities. On October 9, 1986, the U.S. Senate ratified accession to the Convention on Wetlands of International Importance especially as Waterfowl Habitat. U.S. participation in the Convention will complement domestic wetlands protection and legislation, and provide a framework for sharing U.S. technology and expertise. The U.S. now does not envisage making any cash contributions to the Convention, but the FWS intends to provide technical data regarding wetlands inventory, classification, monitoring, and management in order to further international wetlands conservation.

FWS implements the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, calling for cooperation in the management of migratory species, control of trade in rare species, and protection of habitat. FWS activities in FY 1986 included cooperative research, training, cooperative planning, and the conduct of model projects for replication elsewhere in Latin America. The program was administered by two full-time positions in the Department of the Interior, at an annual cost of $322,000. Foreign resource investments perhaps included as many as 25 man-years. Mutual activities under the Convention include the conservation of migratory birds, and the preservation and enhancement of biologic diversity.

FWS is active in training efforts and providing technical assistance to foreign officials, and also conducts a wide range of bilateral activities, especially with Canada and Mexico. The number of different parts of FWS involved is so large, and the work so much an extension of domestic operations, the specific resources invested, U.S. and foreign, cannot be quantified easily.

Significant cooperative programs also are undertaken with Egypt, India, and Pakistan, utilizing U.S.-owned counterpart funds derived from P.L. 480 assistance, and authorized for use under the Endangered Species Act of 1973. Activities include training, species and habitat research, education, public awareness development, scientific symposia, and planning. These activities are implemented by one full-time position at a cost of $45,000 per year, plus about $10,000 in miscellaneous FWS expenses. Foreign resources used in FY 1986 were approximately 15 man-years plus $700,000 equivalent in special foreign currencies. These programs provide substantial benefits to the development of effective conservation of the biologic diversity, and the protection of endangered wildlife and habitat in all three participating countries.

The Department of State continued to play an active role in FY 1986, in international wildlife conservation efforts, especially with regard to enforcement activities by FWS, U.S. Customs, Department of Justice, and USDA, intended to curtail illegal trafficking in wildlife and wildlife by-products. The Department provided U.S. missions abroad with a regular flow of information on such aspects as pertinent laws and interests of agencies and nongovernmental organizations.

Embassy officers, inter alia, developed information necessary for enforcement of the Lacey Act and the Endangered Species Act, and sensitized foreign officials to the importance of protecting endangered species of wild fauna and flora. In light of the critical situation of the rhinoceros, highlighted by Congressional hearings, the Department of State coordinated U.S. efforts in late 1986 with other countries to save the rhinoceros. The Department of State assisted FWS in implementing its ban on all wildlife shipments from Singapore, and also in obtaining the cooperation of Singapore in halting rhinoceros horn trade and complying with CITES provisions.

Biologic Diversity Initiative. FWS detailed an advisor in FY 1986 to AID to provide assistance with efforts to assure adequate consideration of biologic diversity concerns in AID programs. Activities included preparing an annual report to Congress as specified in the Foreign Assistance Act, technical assistance to AID missions, and planning for an expanded AID biologic diversity initiative in subsequent years. Cost associated with this project was approximately 1.5 staff-years and $113,000. An expanded agreement between AID and FWS was signed in late FY 1986 and calls for continuation of the detail at a level of two staff-years and $250,000. The work will involve preparation of pilot review studies, biologic diversity initiatives in Africa, and training material.

FWS also has an agreement with the Asia and Near East Bureau of AID to administer a small grants program in support of biological diversity. To date, approximately 0.3 staff-years and $240,000 of AID funds have been allocated in support of small grants in India, Turkey, Oman, Morocco, Yemen, and Jordan. FY 1986 expenditures for the small grants program totaled over $1 million from contributions by FWS (primarily Special Foreign Currency Funds), AID, and participating countries. Efforts include funding for biodiversity survey work, sea turtle research, education efforts, and support for a conservation film project.

The small grant approach has proven very effective in maximizing cooperative efforts, and grantees are required to make substantial commitments of funds or in-kind services. Although individual grants are relatively small, they are in a range that can effectively be utilized by the recipient and can have significant impact for starting beneficial projects. AID dollar funding for this project also allows FWS to maximize effectiveness of it's rupee-funded programs in India and Pakistan.

USSR. FWS participates in conservation activities with the Soviet Union under the U.S.-USSR Environmental Agreement. During 1986, four delegations of botanists and marine mammal biologists from both countries were exchanged for short-term research work at an estimated cost of $55,000. FWS contributed approximately $15,000 of this cost, with the balance provided by other participating federal agencies, academic institutions, and private organizations. (USSR costs for 1986 were estimated to be roughly equivalent to U.S. expenses.)

Focusing primarily on rare and endangered species, the program seeks to foster sound wildlife protection practices. It also has created a non-confrontational forum for US-Soviet cooperation. Such initiatives can be expected to continue in the future.

People's Republic of China. In cooperation with the National Park Service, FWS in 1986 negotiated a bilateral Protocol on Nature Conservation with the Ministry of Forestry of the People's Republic of China (PRC). This protocol will be implemented under the 1979 U.S.-PRC Agreement on Cooperation in Science and Technology, and will provide the framework for exchanges in protected natural areas (i.e., parks, refuges, forest reserves), rare and endangered animals, migratory birds, fish husbandry and marine mammals, botanical research, cooperation among zoos, ecosystems studies, use of technology, and animal exchanges for captive propagation.

Expenditures were about $15,000 during FY 1986, with the Chinese side spending an equivalent amount.

International Park Activities

The National Park Service (NPS) in FY 1986 was involved in 138 separate projects relating to over 83 nations. The projects were executed in collaboration with other U.S. government agencies, foreign counterpart agencies, international institutions, and American and foreign nongovernmental organizations. NPS projects fell into the following broad categories:

1. Technical assistance in the design, planning, development, monitoring, management, and evaluation of national park and park related projects overseas. Resources invested included $365,000 by NPS, and approximately $1.3 million by other parts of the U.S. government, foreign governments, domestic and foreign institutions, and domestic and foreign organizations.

2. Training for foreign officials in the conservation of natural and cultural resources. In FY 1986, 605 training and orientation programs were provided to representatives of 52 nations. Approximately two thirds of these programs related strictly to conservation of biologic diversity. A total of 4,236 training days were accumulated at various NPS sites in the U.S. Resources invested included $110,000 by NPS, and $598,000 by other parts of the U.S. government, foreign governments, and domestic and foreign institutions and organizations.

3. The exchange of general park information and specialized research findings on parks and park related matters is practiced routinely with other nations. Guides, planning manuals, computer link to international data exchange, "Parks" magazine, scientific papers, books, and other materials are exchanged and then adapted to individual countries'

needs. Approximately 200 requests for information are received each month. Resources invested include $67,000 by NPS, and $98,000 by other parts of the U.S. government, foreign governments and domestic and foreign institutions or organizations.

4. The NPS participates in conferences, workshops and seminars on a professional basis as well as by legal mandate under Public Laws and bilateral agreements with other nations. Resources invested include $112,810 by other parts of the U.S. government, foreign governments and domestic and foreign institutions or organizations. NPS expends no resources for these activities.

5. Policy coordination includes the World Heritage Convention, the Panel on Conservation, Recreation, and Parks under the U.S.-Japan Agreement on Natural Resources, the U.S.-PRC Program on Natural and Cultural Heritage, the Western Hemisphere Convention, the German Youth Exchange, membership in the International Council on Monuments and Sites (ICOMOS), membership in the International Union for the Conservation of Nature and Natural Resources (IUCN), and an Action Plan for U.S. Strategy on Biological Diversity. Resources invested included $59,000 by NPS, and $250,000 by the U.S. Government, foreign governments, and domestic foreign institutions and organizations.

NPS receives a variety of requests from foreign governments and private organizations for its involvement in training, technical assistance, and other activities. Project sheets, describing objectives, activities, funding, dates, and duration are maintained for all the requests.

During FY 1986 NPS received requests for 139 bilateral projects in 47 countries, and 39 multilateral projects involving Africa, Latin America, ASEAN countries, World Heritage Convention countries, Western Hemisphere Convention countries, and worldwide projects. Of the total 178 project requests, 104 projects are completed or ongoing.

These figures represent a doubling in the number of requests in comparison to FY 1985, an increase attributable in part to more detailed tracking of projects, and in part to increased activity in some regions of the world that generated additional project requests. See Tables 8.1 through 8.6.

Table 8.1: Categorization of the project ratio for NPS by type of activity.

Type of Activity	Project Requests	Completed or Ongoing Projects
Technical Assistance	62	36
Training	63	29
Information Exchange	10	9
Policy Coordination	26	20
Conference/Workshop	17	10
Total	178	104

Table 8.2: Regional categorization of NPS projects.

World Regions	Projects Requests	Completed or Ongoing Projects
North America	12	10
Latin America and the Caribbean	55	22
Africa	23	18
Europe	12	7
Asia	54	27
Oceania	2	1
Multi-Regional	20	19
Total	178	104

Table 8.3: NPS projects categorized by signatories of the convention on nature projection and wildlife preservation in the western hemisphere.

Country Status	Project Requests	Completed or Ongoing Projects
Western Hemisphere Convention countries	42	20
All other countries	136	84
Total	178	104

Table 8.4: NFS projects categorized by signatories of the convention concerning the protection of world cultural and natural heritage.

Country Status	Project Requests	Completed or Ongoing Projects
World Heritage Convention countries	94	47
All other countries	84	57
Total	178	104

Table 8.5: NPS projects in caribbean basin initiative countries.

Country Status	Project Requests	Completed or Ongoing Projects
Caribbean Basin Initiative countries	20	8
All other countries	158	96
Total	178	104

Table 8.6: NPS activities related to biological diversity.

Project Status	Project Requests	Completed or Ongoing Projects
Biological Diversity Projects	161	95
Cultural Projects	17	9
Total	178	104

In addition to activities and projects, NPS programs encompass training and orientation for foreign park professionals to U.S. National Parks. NPS programmed 605 visitors from 52 countries for a total of 4,236 training days during FY 1986.

The U.S. continued its active participation in the World Heritage Convention that was ratified by the Senate in 1973. Three U.S. properties were identified during FY 1986 for possible nomination as internationally significant examples of the World Heritage. Also during FY 1986, the U.S. assisted 47 member nations in the conservation of unique natural reserves, continued its voluntary contribution to the World Heritage Fund ($239,000 in FY 1986) for assistance in natural and cultural resource projects, and announced its intention to seek in 1987 re-election to the World Heritage Committee.

The U.S. and other cooperative nations derive substantial benefits from international park activities and programs. The U.S. gains access to the latest state-of-the-art technology and source material, and is in a position to monitor, access, and adapt to U.S. use the latest professional advances in park, protected area, and wildlife planning and management. Communication with other participants in the World Heritage and Man and the Biosphere Reserve programs, as well as cross-border cooperation with Canada and Mexico, has been enhanced. Developing countries are made aware of natural resource concerns, and are encouraged to plan for sustainable economic growth. The U.S. is seen as visibly responsive to governments requesting assistance in conserving their national heritage. Both sides of the exchanges are developing greater mutual understanding about concerns for common global resource conservation.

Department of the Army: Corps of Engineers

The department of the Army and its Corps of Engineers is engaged in several S&T exchange programs and joint research projects with various foreign countries related to the conservation and development of water resources, including flood control, coastal navigation, shore protection, and other matters. Through bilateral arrangements for the exchange of information, collaborative research projects, reimbursable technical assistance, and participation in international organizations, the Corps of Engineers derive benefits for the U.S. domestic civil works programs while supporting foreign policy objectives defined by the Department of Defense and the Department of State.

U.S. Geological Survey

The U.S. Geological Survey (USGS) has been involved in international programs for more than 40 years, focusing on two general types of activities. The first is technical assistance to foreign governments or international organizations utilizing funds from other Federal agencies, foreign governments, or international institutions as authorized under the Foreign Assistance Act. These programs involve technology transfer to foreign nationals through advice, training, demonstration, and direct assistance by Survey personnel.

Second, USGS participates in bilateral and multinational scientific cooperation with foreign counterpart organizations through cooperative agreements in order to achieve common research objectives. Financial resources are appropriated for USGS research or made available by cooperating countries or organizations. Foreign participants generally, pay their own expenses. Activities range from informal scientist-to-scientist discussions and correspondence to formal jointly staffed research projects and multinational projects focused on particular problems or topics that are coordinated internationally. USGS has formal cooperative agreements with counterparts in 40 countries, and participated in S&T activities with counterparts in 67 countries during FY 1986.

Scientific Exchanges and Training. Exchanges involved 57 foreign scientists from 20 countries visiting USGS laboratories to participate in cooperative research. USGS presented formal training in the U.S. for 11 foreign scientists from 7 countries in the "25th International Remote Sensing Course", and 16 foreign scientists from 10 countries in Techniques in Hydrologic Investigations. In addition, 25 officials from Latin American governments attended a seminar on environmental hazards and remote sensing sponsored by the AID Office of U.S. Foreign Disaster Assistance (OFDA). Foreign training workshops and seminars were held on Mineral Resources Assessment Methods in Brazil, Symposium on Extraordinary Flood Events in China, Central America Seminar on Deposit Modelling and Mineral Resources Assessment in Costa Rica, Basin Analysis and Coal Resources Assessment in India, Coal Basin Evolution of ESCAP Region in Indonesia, Volcanic Hazards in Indonesia, Petroleum Resource Assessment in Malaysia, Application of Remote Sensing to Hydrologic and Mineral Resource Assessment in Morocco, International Workshop on Mineral Deposit Modelling in the Philippines, and Agrogeology and Fertilizer Minerals in Thailand. USGS also participated in the First Pakistan National Coal Conference and organized the Geochemistry of Coal Symposium in Pakistan.

Energy and Mineral Resources Studies. USGS conducts research in foreign energy and mineral resources in order to expand basis for assessing the domestic energy and mineral resources potential, and to assess foreign potential for satisfying U.S. and world needs for certain resources. During FY 1986, USGS scientists continued studies of foreign petroleum resources through the World Energy Resources Program, and reported on the petroleum potential in China, South Asia, and the Baltic Basin.

Coal resources studies were made at AID request in Costa Rica, Pakistan, and Mauritania. Geothermal studies were made at AID request in Costa Rica and Honduras. USGS continued to coordinate the International Strategic Mineral Inventory (ISMI), a worldwide compilation of the major sources for strategic minerals. Geoscience organizations from Canada, U.K., FRG, Australia, and South Africa provide data and collaborate in this compilation. USGS published ISMI reports on nickel and platinum during FY 1986. Survey scientists made reconnaissance studies of manganese in Gabon, titanium-sands in Mozambique and Mauritania, nickel and platinum in Morocco, sulfide deposits in Japan, and gold and other minerals in Costa Rica, Liberia, Palau, and Papua New Guinea. These studies were made at the request of local governments, the Department of State, and AID in order to support U.S. foreign policy objectives. The USGS participates in these resource studies and provides training, advice, and assistance as an economic means of developing reliable and sufficient geologic and resource information required for USGS domestic research and resource assessment programs. USGS and the Bureau of Mines advise and assist the Department of State as principal users of mineral and energy resources information provided by Regional Resources Officers and Minerals Reporting Officers in U.S. Embassies around the world. USGS provides field training and orientation consultations in the U.S., and in foreign countries for Regional Resources Officers.

USGS in cooperation with the USDA, has undertaken a new program of international agrogeology assistance in Yugoslavia and Mauritania. This new cooperative program provides a broad line of interdisciplinary expertise to identify ways of achieving increased and sustainable agricultural production in developing countries. These countries use internal sources of agricultural minerals and domestic coal and peat to reduce depletion of forests for firewood. These interdisciplinary studies are developing techniques and information that are expected to have important applications in U.S. domestic agriculture, such as reducing costs of agricultural inputs, reducing pollution, and increasing effective use of irrigation waters.

Geologic Hazards Programs. USGS continued to provide advice and assistance to foreign geoscience organizations for installation, maintenance, and operation of a series of worldwide seismic monitoring networks. Under the auspices of the protocol between the People's Republic of China and the U.S. for Scientific and Technical Cooperation in Earthquake Studies, USGS and the PRC State Seismological Bureau (SSB) have worked cooperatively in the design, construction, installation, operation, and maintenance of a nine-station digital seismographic network. USGS has designed and developed the hardware and software for the network, purchased four of the data systems, purchased software for a Data Management System that is located in Beijing, supplied parts and equipment for a depot maintenance center, and provided training for SSB engineers and technicians. SSB prepared all sites and facilities for the equipment, and provided funds for the purchase of five data systems and the data management system. The stations that constitute the network began initial operation and testing during the summer of 1986, and are located in Beijing, Lanzhou, Kunming, Mudanjiang, Hailar, Enshi, Sheshan (Shanghai), Qiongzhong (Hainan Island), and Urumqi. The China Digital Seismograph Network (CDSN) is one of the most advanced seismic systems in the world, and it will provide valuable data for assessing the crustal structure and evolution of the Asian continent and the location and properties of Chinese earthquakes. It will advance USGS understanding of the global distribution of earthquakes, and will provide important data for ongoing cooperative USGS-SSB earthquake prediction studies in China.

A new Global Telemetered Seismic Network is being developed to strengthen real-time seismic recording in the Southern Hemisphere. USGS during 1986 developed agreements and made site tests of suitability for recording stations in Antarctica, South Africa, Botswana, Central African Republic, Ivory Coast, Argentina, Bolivia, Brazil, and Paraguay. These data are compiled by the USGS Global Seismic Data Base and allow rapid identification of the location and magnitude of major seismic events worldwide. It alerts Department of State and AID/OFDA to potential damage to property and life in remote areas. USGS scientists utilize these data for more effective assessment of earthquake risk and for identifying methods to mitigate earthquake effects.

USGS continued to provide technical assistance and advice to Colombia in response to the 1985 eruption and catastrophic landslides at Ruiz Volcano. USGS scientists at AID/OFDA request also made an immediate investigation of the disasterous gas emission from crater Lake Nyos in northwestern Cameroon. Analysis of field data and samples from Lake Nyos continues.

Hydrology. Technical assistance in hydrology involving about two staff years of effort was extended by USGS in FY 1986 to 13 foreign nations, primarily in Africa, the Middle East, and the Caribbean. Activities ranged from hydrologic hazards evaluations (e.g., toxic gases from Lake Nyos in Cameroon, mudflows from Nevado del Ruiz Volcano in Colombia, and flooding on the Panama and Paraguay Rivers in Paraguay) to consultation and assistance in water-resources data collection and analysis (e.g., water-quality modeling in the PRC, sediment studies in the Orinoco River in Venezuela, water-resources reconnaissance of Abu Dhabi in the United Arab Emirates). USGS was reimbursed for most costs of these activities by other Federal agencies, primarily AID or recipient foreign governments.

Scientific cooperation in hydrology in FY 1986 involved USGS personnel in an additional two staff-years of effort on studies with scientists from at least 15 nations. Many cooperative research projects included studies of hydrologic systems or conditions not readily available in the U.S. The scientific results from these studies contribute directly to the understanding and resolution of domestic water-resources problems (e.g., mudflow studies in Japan, geochemistry of regional ground water flow systems in Spain, and lake eutrophication in Canada). Other cooperative projects were undertaken in support of the missions of other Federal agencies (e.g., airborne radar ice sounding in Greenland, evaluation of nitrogen in ground water in Yugoslavia, marginal sea-ice studies in the Arctic). Funding for these cooperative activities was provided jointly by USGS, a variety of other Federal agencies, national and international scientific organizations, and host-country governments.

Benefits to U.S. Foreign Policy. Benefits to U.S. foreign policy from USGS international S&T activities include a reduced need for U.S. economic support in friendly developing countries resultant from assistance in resource identification and development, identification of alternate energy sources and indigenous fertilizer minerals that can help mitigate or reverse advance of desertification and reduce famine in the African Sahel countries, highly visible signal of support for bloc countries which attempt to reduce their dependence on Soviet technology, demonstration of U.S. leadership in guiding scientific programs of the U.N. and other international geoscience organizations, assurance of U.S. private sector access to resource information for developing countries produced, and generally closely held by former colonial powers such as France and Britain or by the Soviet Union, and access to latest geoscience information, technology, and expertise in industrial countries.

Plans and Priorities. USGS continues to work closely with the Department of State, AID, and other agencies in focusing advice and assistance activities in countries of strategic importance to the U.S. Expanded consultations during 1987 are planned to assist Sahelian countries in combating the advance of desertification. Cooperation with other African countries also will be expanded, including design of a volcanic hazards program in Cameroon. Development of a computerized geographic information system (GIS) for Africa is under consideration for supporting analysis and early warning of drought, locust, and other regional disasters. Focus will be placed on assessment of indigenous agricultural minerals for supporting expanded food production, and on identification of peat and coal for replacing firewood and imported oil as a domestic fuel. Compilation of data on world energy and strategic and critical minerals will continue. Advice on foreign mineral development will focus on strategic minerals and precious metals. Advice and assistance will be provided, when possible, for training officials of developing countries to monitor and mitigate geologic and hydrologic hazards. The extent and magnitude of all this work will depend upon requests and funding support from AID, international development organizations, and foreign governments.

Summary of Expenditures for USGS S&T Cooperation, FY 1986.

Saudi Arabian geology and mineral resources (Saudi Arabia)	$6,300,000
Saudi Arabian water resources assessment (JECOR)	1,000,000
Saudi Arabian seismic monitoring (JECOR)	175,000
Indonesia volcano hazards monitoring (AID/OFDA)	280,000
Indonesia volcano hazards monitoring (Asian Development Bank-ADB)	70,000
Indonesia marine geology and environmental geology (ADB)	121,000
Strengthening of Bangladesh Geological Survey (ADB)	123,000
Pakistan coal resource assessment (AID)	600,000
Liberia gold resource assessment (AID)	50,000
Costa Rica mineral resources assessment (AID)*	460,000
U.S.-Spain Binational Research	325,000
Jordan seismic hazards monitoring (AID)	90,000
Abu Dhabi water resources assessment (Abu Dhabi)	52,000
Hungary petroleum resource assessment (World Bank)	70,000
SOPAC marine geology surveys (AID)	725,000
Geologic hazards monitoring in Italy, Latin America, and Pacific area (AID/OFDA)	401,000
Honduras, Costa Rica, Geothermal Assessment (AID)*	200,000
Antarctic mapping (NSF)	400,000
Antarctic mapping (DMA)	150,000
Mexican border mapping (U.S. Customs Service)	85,000
Mexican border mapping (IBWC-U.S. Section)	65,000
Other non-U.S. Government funding	83,000

* In cooperation with Los Alamos National Laboratory

USGS expended approximately $3.2 million of its own funds on international programs. Other Federal agency funding totaled about $2.8 million, and non-U.S. Government funding totaled about $9.0 million; about $7.5 million of this money was from Saudi Arabia. The USGS programs in Table 8.7, subject to yearly appropriations, contribute significantly to overall S&T cooperation in geosciences and have a significant impact on U.S. access to international geoscience information.

Table 8.7: FY 1986 funding for continuing USGS programs.

Program	FY 1986 appropriation
World Energy Resources	$ 497,000
Strategic and Critical Minerals	9,188,000
Earthquake Hazards Reduction	34,332,000
Volcano Hazards	10,161,000

Bureau of Reclamation

The Bureau of Reclamation (BOR) is involved in internationally reimbursable technical assistance programs, S&T cooperative agreements, and training programs for foreign nationals in water resources development or related activities, either on site or in the U.S. Noteworthy developments in FY 1986 include technical assistance project initiatives in Brazil and Pakistan.

The Government of Brazil plans a major irrigation program to develop a million hectares (i.e., approximately 2.5 million acres) of new irrigated agriculture in the drought-prone Northeast. The Brazilian government and BOR have executed an agreement whereby the BOR would provide Brazil with three years of technical assistance in the development of water projects in the Northeast region, beginning in early 1987. The enormous scope of this project will allow BOR engineers to develop new skills, and to learn new methodologies. The U.S. private sector could benefit through opportunities to form joint ventures with Brazilian firms for contract work on the project.

BOR initiated a training program in FY 1986, with Pakistan that will be funded by AID. Over the next two years, BOR will train 21 Pakistani engineers in various aspects of planning, design, construction, operation, and maintenance of irrigation and drainage facilities. Training programs will reflect the professional needs and interests of the individual trainees, focusing on particular aspects of project development. Trainees will spend three to four months in training in the U.S. at ongoing project sites.

BOR continued involvement during FY 1986 in the planning of a major hydrologic investment in the PRC. The Three Gorges Dam and Power Plant on the Yangtze River would include a 540-foot-high concrete gravity dam stretching 6,300 feet across the Yangtze River, and a 13,000 megawatt power plant. This year, 12 specialists spent a total of 45 weeks advising China on the plans for this massive project. Future U.S. involvement could lead to opportunities for private sector participation in engineering, construction, and equipment supply contracts.

In addition to initiating programs with Brazil and Pakistan, BOR continued cooperative S&T programs with Israel and Spain. Other countries receiving BOR advisory assistance in FY 1986 included Ecuador, Egypt, Malaysia, Morocco, Saudi Arabia, Somalia, Sudan, and Zaire. BOR specialists gain knowledge and skills through these programs, relevant to ongoing domestic projects, and members of the private sector have the opportunity to participate in project work under contract with the foreign governments.

Bureau of Mines

International S&T activities of the Bureau of Mines (BOM) cover two main categories. They are research cooperation and scientific exchange visits as an extention of domestic programs as a long-term, traditional activity, and technical assistance and training at the request of the U.N. and its specialized agencies, the AID, the International Visitors Program of the U.S. Information Agency, and other governments. This latter activity was begun in the 1950s.

BOM in FY 1986 arranged training programs for three U.N. Fellows from India in different aspects of mineral economics, minerals, and materials research. It also provided information to visiting mining officials from Australia, Austria, Bolivia, Canada, China, Egypt, the European Communities, India, Indonesia, Japan, Jamaica, Malaysia, Mozambique, Norway, Pakistan, South Africa, Sweden, Turkey, the U.K., USSR, and Zaire. BOM experts also provided assistance abroad or took part in international, multilateral and bilateral meetings at the request of other governments and international organizations. Requests were received from Argentina, Australia, Brazil, Canada, China, Mexico, Saudi Arabia, Spain, Sweden, the U.K., and the International Lead-Zinc Study Group.

Important cooperative research activities in FY 1986 included one new and several ongoing joint research projects with four cooperating research institutes in Yugoslavia at a cost of $30,000 from the BOM research program funds and $93,000 from the U.S.-Yugoslavia Joint Fund. Collaboration with the Canada Centre for Mineral and Energy Technology, covering a broad spectrum of research topics in health, safety, and environmental control in mines, has been expanded to include a new cooperative research project on rock mechanics and ground control. U.S. expenditures are offset by the benefits received from research shared by Canadian counterparts. Cooperation with the U.K. National Coal Board in R&D of mining technologies has been enhanced by transferoot bolting technology from the U.S. to the U.K. in exchange for transfer of selected U.K. technologies, such as coal-face automation and single entry longwall development. Expenditures include $15,000 from BOM funds. A $60,000 joint research project with Spanish scientists on the high temperature direct reduction of iron ore was funded under the U.S.-Spain Joint Committee for Scientific and Technological Cooperation. All these activities are of immediate and direct benefit to the BOM, the U.S. mining industry, and their foreign counterparts, permitting both financial savings and improvement of the technical mining technology base.

BOM continued an active exchange of mineral scientists with China. Nearly 50 Chinese coal and non-ferrous mining officials and experts visited BOM facilities during FY 1986. The BOM also continued to negotiate protocols for technical cooperation with both the China Ministry of Coal Industry and the China National Nonferrous Corporation. The protocol provision of "sending side pays" remained a problem for the Chinese.

National Oceanic and Atmospheric Administration (NOAA)

Drought and Disaster Early Warning and Technical Assistance. The NOAA National Environmental Satellite Data and Information Services (NESDIS) is using climatic impact assessment technology to support drought and disaster early warning and technical assistance. This activity is in support of the objectives of the AID Office of Foreign Disaster Assistance. The NESDIS Assessment and Information Services Center (AISC) currently provides the U.S. agencies and AID Missions with operational monthly assessments of weather impacts on the food security of more than 80 developing countries throughout the tropics. NOAA/NESDIS with support from AID, is assisting approximately 30 developing countries with implementation of similar national programs to detect drought, to qualitatively assess weather impacts on crops, and to forecast the potential for drought-induced food shortages. NOAA assessment technology more recently, has been upgraded through the use of daily NOAA polar-orbiting meteorologic satellite data, and a new program has been developed by NOAA and AID for Africa.

The purpose of the NOAA-AID Special Climatic Impact Assessment Program for Africa is acceleration of the rehabilitation and disaster recovery process associated with recent African drought and famine. The program is designed to significantly improve the capability of the Sahelian countries, as well as Sudan, Somalia, and Ethiopia for operationally assessing the impact of weather on agriculture (food crops and rangelands). The program also is using these assessments as timely, reliable quantitative input to agricultural crop production forecasting, agricultural policymaking, and rangeland management. Assessments available to U.S. and host country officials also will be used for drought relief planning whenever necessary. AISC since July, 1985, has prepared special climatic impact assessment reports which are air expressed to U.S. Missions. AISC is providing in-country technical assistance on the interpretation and use of these assessments.

U.S. Government funding of the assessment program since 1978 has totalled approximately $6.5 million. About $1.8 million of this has been devoted to technical training, the remainder has supported development and distribution of climatic impact assessments. Foreign country investments involve designation of technical and policy-level personnel to participate in seminars and training programs, as well as the collection and provision of local ground truth information. Upon completion of the technical assistance program, each country will modify its ongoing climate assessment programs to incorporate the new methodologies and techniques from this project.

The humanitarian benefits of this program are both immediate and long term. Drought monitoring and crop condition assessments contribute directly to food security programs and also can supplement existing crop production forecast systems. The resulting improved policy and food security management decisions at the national and international levels can lead to the mitigation of regional food shortages, if timely and open information is available to develop appropriate strategies.

Economic benefits are felt within the impacted region and beyond. The AISC assessment technology can provide potentially affected countries with early warning of impending problems, and promote the maintenance of economic and social stability. In addition to political benefits for the U.S., these programs provide a real test case for demonstrating new techniques and improving understanding of a variety of climate situations. The locally collected ground truth data also are a significant asset in the development and refinement of global and regional agroclimatic and satellite assessment models.

It is anticipated that each country involved in AISC-AID projects will develop its own climate impact assessment system using the techniques provided through these activities. The ultimate result will be improved understanding and management of global food supplies and increased food security.

Conservation of Marine Protected Areas. The National Ocean Service of NOAA sponsored the International Marine Protected Area Management Seminar on June 1- 12, 1986. The seminar focused on the approaches available for the protection and sustainable use of various types of designated marine areas including marine national parks, fisheries and marine wildlife reserves, and protected underwater historical resources. Attendants at the seminar included 29 participants from 22 countries. The major tropical, warm temperate, and cold marine regions were represented including the Caribbean, North Atlantic, Mediterranean, South and Western Pacific, Indian

Ocean, and others. A commitment was made to continue international information exchange through the establishment of an international network for individuals involved in the establishment, planning, and management of marine protected areas; and the publication of an international newsletter in collaboration with the U.S. Man and Biosphere Program as a service to the network.

U.S.-PRC Protocol on Cooperation in the Field of Atmospheric Science and Technology. The Sixth Session of the Joint U.S.-PRC Working Group (JWG) on Atmospheric Science and Technology was held at Beijing, September 16-22, 1986. The Joint Working Group (JWG) reviewed progress in the research and operational meteorologic program areas and adopted a broad range of activities.

Under the Monsoon Research Program, seven projects were identified for cooperation. Priorities for these projects will be set at the Third Joint Monsoon Workshop to be held in June, 1987 at Kunming, China.

The second experiment in the Tibetan Plateau and Mountain Meteorology Program - Tibetan Plateau Meteorological Experiment-86 (TIPMEX-86) took place in Lhasa and Nagqu, Tibet. Eight U.S. scientists used three portable U.S. observational systems in the field program, which will be followed by the analysis phase.

Climate studies included a joint review paper on historical climate data that will be completed at a joint historical climate workshop in the U.S. in the summer of 1987. The paper is expected to be published in the U.S. under joint authorship. The development of a historical data record processing system, paleoclimatic modeling, and numerical modeling techniques in China for simulating climate and climate change were identified as areas of potential cooperation. Joint collection and analysis of tree ring samples from western China was another area under active consideration.

The JWG considerably expanded the scope of planned activities in mesoscale meteorology because of its importance in local severe weather forecasting. Chinese experts in techniques of forecasting heavy rain will visit the U.S. in early 1987 to observe U.S. forecasting techniques in return for a visit to China by U.S. experts in 1985. The U.S. invited Chinese experts to participate in the planning of the U.S. STORM Program, and the PRC invited U.S. participation in several mesoscale experiments to be conducted in China.

Population

International Policy and Programs. The Department of State's Office of the Coordinator of Population Affairs has responsibility for coordinating U.S. international population policy. The goal is the enhancement of effective U.S. programs, of programs of other nations, and of activities of international organizations in this area. U.S. international population assistance programs are implemented by the Agency for International Development (AID). Cooperation between the Department and AID is close and continuous.

U.S. policy emphasizes continued strong support for voluntary international family planning programs, for integration of population and economic development policies, for the critical role a market-oriented economy can play in achieving population goals, and for prohibition of any U.S. support for coercion or abortion in family planning programs. Implementation of this policy resulted in no U.S. funding for the International Planned Parenthood Federation (IPPF) in 1985 and 1986 because this organization supports abortion activities through some of its affiliates in developing countries.

Last year, AID withheld $10 million from the 1985 contribution to the U.N. Fund for Population Activities (UNFPA) because of the assistance UNFPA provided to the population program of the People's Republic of China. The $10 million was reprogrammed to other family planning projects. No U.S. contribution was made to UNFPA in 1986 because there was not sufficient change during the year in the Chinese population program or in the UNFPA program in China.

Resources Invested in International Population Activities

The U.S. provided $239 million in FY 1986, for population assistance programs; this accounted for 44 percent of the total amount contributed by developed countries. Other donors, led by Japan, have pledged to increase the level of their assistance in future years. The developing countries provide about half, or approximately $500 million, of the total resources for population programs.

Implications for the Future

International efforts on population programs have been among the most successful examples of international cooperation. While trends have been positive, there has been little reduction in fertility rates in a number of countries. The absolute number of people seeking voluntary family planning services is still very great, and annual increments to the population continue to grow at a current rate of 80 million annually. The population in the year 2000 is expected to increase from today's 5.0 billion to 6.1 billion.

The primary U.S. objective continues to be encouraging developing countries to adopt sound economic and population policies consistent with respect for human dignity and family.

Population planning assistance is an ingredient of a comprehensive programs that focuses on the root causes of development failures. The U.S. program as a whole, including population assistance, forms the basis for well-grounded, step-by-step initiatives to improve the well-being of people in developing countries and to make their own efforts a key building block of development programs, particularly through expanded private sector initiatives.

Chapter 9 - HEALTH

Scope and Description of Activities

International health cooperation is an important concern of the U.S. Government. The purposes of international cooperation in the health sciences generally fall into four categories:

1. Advancing domestic health objectives, notably through research and exchange of scientific information, foreign quarantine activities and food and drug regulatory activities;

2. Responding to humanitarian concerns, such as natural disasters and epidemics;

3. Serving foreign policy and development objectives of the Department of State and AID, particularly through participation in bilateral cooperative science programs; and

4. Representing the U.S. Government in international health forums, including the promotion of U.S. policies.

Since health is a fundamental and universal concern of all nations, international health cooperation is a high priority. Moreover, U.S. excellence and leadership in the health field adds to the stature of this country in the world community.

The U.S. Government's international health involvement has expanded and evolved over four decades to a level where it plays an important role in U.S. diplomatic efforts. A significant number of federal agencies are engaged in international health and health-related activities. These include the Department of Health and Human Services (DHHS), the Agency for International Development (AID), the Department of Agriculture (USDA), the Department of State, the Peace Corps, the Department of Commerce (DOC), the Department of Labor, the Department of Education, the Department of Transportation (DOT), the Department of Defense (DOD), the Environmental Protection Agency(EPA), the National Science Foundation (NSF), and the Drug Enforcement Administration (DEA).

DHHS is the principal health science agency of the U.S. Government, and this chapter deals primarily with the programs and activities carried out by DHHS, and in particular by the Public Health Service (PHS). (Health-related international programs of USDA and AID are reviewed in Chapters 5 and 14, respectively.) It also should be noted, however, that the Department of State, including its embassies and consulates overseas, plays a prominent and key role in the field of international health. They facilitate contacts between U.S. public and private sector institutions and their foreign counterparts by collecting and exchanging information and data at the international level, and by assisting with the negotiation and implementation of cooperative health agreements.

All five line bureaus of PHS -- the Alcohol, Drug Abuse and Mental Health Administration, the Centers for Disease Control, the Food and Drug Administration, the Health Resources and Services Administration, and the National Institutes of Health -- as well as the National Center for Health Statistics, and National Center for Health Services Research, are involved in international cooperation. Programs are carried out through a variety of mechanisms, ranging from grants and contracts to individual exchange programs and bilateral agreements. Some agreements correspond to regulatory activities to protect U.S. consumers or surveillance activities to safeguard the health of the U.S. population against the importation of disease. Others include participation in umbrella Science and Technology Agreements or agency-to-agency agreements in specific subject areas.

DHHS expenditures for international activities are from domestic appropriations, even though some of these appropriations provide for activities that are inherently international in nature, such as foreign quarantine, tropical disease research, and quality control of food, drug and cosmetic importations. As a result, about $70 million was expended in FY 1986 by the five PHS agencies for international activities, including competitive research awards, scientist exchange programs, regulatory activities, and other bilateral program activities.

There are two PHS appropriations which are explicitly for international activities: the appropriation for the Fogarty International Center, National Institutes of Health (FIC/NIH), and the Special Foreign Currency Appropriation (*i.e.*, P.L. 83 - 480). The latter allows PHS to engage in cooperation in the health sciences using U.S.-owned excess foreign currencies.

PHS also cooperates actively with AID in furthering the U.S. Foreign Assistance Program. Under some 26 interagency agreements with AID, PHS draws upon its special expertise in such areas as family planning program evaluation and logistics systems, nutrition in primary health care, prevention and control of communicable diseases, including the epidemiology of diseases important to developing countries, strengthening laboratory capability, disaster assistance, and research on health issues which are relevant to AID programs.

Multilateral Activities

A focus for DHHS is its participation in the multilateral health organizations, primarily the World Health Organization (WHO), the Pan American Health Organization (PAHO), the International Agency for Research on Cancer (IARC), the United Nations Commission on Narcotic Drugs (UNCND), the Food and Agriculture Organization (FAO), and the United Nations Children's Fund (UNICEF). PHS serves as the principal government liaison with these agencies on all technical matters. The Department of State is responsible for paying the member-government assessment and plays the principal role in foreign policy, fiscal, and legal issues. Representatives from both departments work closely and cooperatively on all issues that come before these organizations in which they both are involved, and jointly comprise the U.S. delegations to the governing body meetings of these organizations. The U.S. as a member government, can influence the direction and priorities of these organizations, both within the technical committees and the governing bodies. Since in many cases these organizations have a close working relationship with, and influence on, health ministries of developing countries, the ability of the U.S. to influence these organizations can have a direct impact on other countries.

The U.S. Government derives major benefits from its participation in these organizations. In the area of Acquired Immune Deficiency Syndrome (AIDS), the U.S. has been able to obtain data reported to WHO and PAHO from member countries, including source country data difficult to acquire directly. This also has saved U.S. resources that would have been necessarily expended if the cooperation had to be developed bilaterally. U.S. assistance in international efforts to combat AIDS has been made through AID grants of $1 million each to WHO Headquarters in Geneva and WHO African Regional Headquarters in Brazzaville, Republic of the Congo. Assistance through WHO has served to lessen the international identification of AIDS with the U.S., to foster open discussion of this global problem, and to organize and effectively utilize funds donated by numerous nations.

The prestige and confidence that these multilateral health organizations enjoy, particularly with developing countries, has facilitated the use of U.S. Government technical experts to assist ministries of health in these countries, expending only cost of travel to the organizations. It allows the PHS to work with these countries, teaching them our approach to health problems, without requiring the development of bilateral agreements and significantly reducing the dollar cost to the PHS agencies. U.S. agency involvement in international organizations also provides the opportunity to interact with several countries or subregions together. For countries sensitive to bilateral contact with the U.S., the multilateral organizations provide excellent fora for communication and cooperation that would not occur otherwise.

Legislation such as the Kassenbaum amendment, and the timing of the payment of U.S. assessments may affect the operations of these multilateral organizations, and their interaction with PHS.

Bilateral Activities

Food and Drug Administration (FDA)

The regulatory activities of the FDA generate a special kind of bilateral relationship. FDA is recognized widely as the leading food and drug regulatory agency in the world, and its policies and actions have significant effects on international trade in foods, drugs, and other regulated products, and on national food and drug policies in other countries. Memoranda of Understanding (MOUs) involve source-country certification to ensure that specific shipments of products have been tested and found to meet the agreed-upon conditions, or that the production conditions are certified to meet U.S. requirements. These agreements typically involve products that have a fairly high probability of being detained for specific contamination problems. A certificate is issued by the exporting country and accompanies the documentation with the shipment. FDA monitors certified shipments, and when it determines that the certificates are reliable, lowers the percentage of shipments it samples. In this way, FDA can decrease its workload while the exporting country avoids the waste involved in shipping products that will be refused entry into the U.S.

FDA has signed MOUs on shellfish certification with Canada, Japan, Korea, Mexico, Iceland, New Zealand and England. A new MOU with Australia has been signed recently. The shellfish agreements are unique in that they are required for shellfish importation. This policy was developed because the laws of most States do not permit sale of shellfish from waters not certified under the National Shellfish Sanitation Program.

Time, testing facilities, and human resources are conserved when FDA can rely on the inspection systems of other countries. Exchange of inspection information regarding compliance with good manufacturing practices and good laboratory practices also enables FDA to expedite approval of new drug applications and food additive applications when the products are manufactured abroad, or the application is based on studies conducted in other countries. If it appears during the validation process that the foreign government's analytical work is not adequate to assure the accuracy and reliability of the certification system, the agreement is terminated. FDA implements a validation program whenever a new agreement is signed.

Direct Bilateral Cooperation

PHS cooperates bilaterally with 39 countries, encompassing all regions of the globe. The following are descriptions of activities with selected countries which were noteworthy in FY 1986 either because of the activities carried out, or because of the strength of the relationship on a scientific level.

People's Republic of China (PRC)

The Health Protocol under the umbrella S&T Agreement, has ten defined areas of scientific cooperation: (1) Infectious and Parasitic Diseases, (2) Cancer, (3) Cardiovascular Disease, (4) Public Health and Health Services Research, (5) Medical Information Science, (6) Immunology, (7) Human Genetics, 8) Reproductive Physiology and Family Planning Techniques, (9) Mental Health, and (10) Food and Drugs, including Pharmacology. U.S. scientists are drawn from PHS laboratories, and on occasion from extramural institutions.

Collaborative studies to test the efficacy of two vaccines against viral hepatitis B have been completed. Large epidemiologic studies also are being conducted to gather information on cardiovascular disease risk factors. In other areas, scientists are being exchanged and a number of U.S.-Chinese co-authored scientific reports have been published. The relatively homogeneous character of the Chinese population and its lack of mobility frequently makes epidemiologic studies of this nature more productive in a short period of time, and usually with a larger cohort population, making such cooperative relationships very useful to U.S. investigators.

On the U.S. side, each participating PHS agency uses its own resources to fund the collaborative research. The receiving side pays in-country costs.

There are no funds earmarked for U.S.-PRC health collaboration. On the Chinese side, funding is provided either by the Ministry of Health or the participating institution.

PHS competitive research awards have been made to investigators at U.S. institutions for research that involves a component of collaboration with Chinese counterparts. There also is an increasing number of Chinese students and scientists receiving training at both PHS laboratories and U.S academic institutions under a variety of non-U.S. Government funding mechanisms.

Egypt

Two events of significance took place during the past year: the U.S.-Egypt Health Agreement was extended for an additional two years, and AID and the Government of Egypt approved an interim funding package of approximately $2 million plus 2 million Egyptian Pounds, thus allowing scientific activity in 20 high priority cooperative health projects to continue for a two-year period.

The 20 projects are conducted jointly by PHS and the Ministry of Health within the framework of the Health Agreement. The projects are categorized as follows: biomedical research, infectious and parasitic diseases; development of health services; environmental and occupational health; pharmaceuticals, biologics, and medical products; and nutrition.

The projects originally were approved by the U.S.-Egypt Joint Working Group on Health Cooperation in June, 1981 and recommended for interim funding in November, 1983. Initial funding for the projects came from remaining U.S.-owned excess Egyptian Pounds available to PHS for obligation prior to termination of the P.L. 480 Special Foreign Currency Program on September 30, 1981.

Extensive cooperation in health between PHS and the Ministry of Health has spanned more than 20 years. Activities conducted under this relationship have resulted in important new knowledge being brought by U.S. scientists in government and academia to the American public health community. Benefits to Egypt have come from advances in public health knowledge, creation of centers of excellence in public health, and the development of a large body of health scientists.

However, continuation of the overall program of health cooperation is in jeopardy because PHS and the Ministry of Health have been unable to identify an on-going source of funding to maintain the cooperative health relationship beyond the interim funding period.

India

The program of cooperation with India in health and medical sciences is now in its third decade. Activities are carried out under the aegis of the Indo-U.S. S&T Subcommission, the Reagan-Gandhi - Science and Technology Initiative (STI), the Vaccine Action Program (VAP), and a number of other relationships, including the U.S. foreign assistance program.

Participating U.S. agencies include the five agencies of PHS, AID, EPA, NIHR, and USDA. Through these organizations, most notably the NIH, a significant number of participating scientists are affiliated with U.S. universities, medical schools, and other institutions. On the Indian side, participating governmental organizations include the Department of Biotechnology, the Department of Science and Technology, the Ministry of Health and Family Welfare, the Ministry of Human Resources, the Council for Scientific and Industrial Research, the University Grants Commission, the Department of Atomic Energy, and the Indian Council of Agricultural Research.

There was cooperation on approximately 100 projects and other activities during FY 1986. These included investigator-to-investigator collaborative research, scientific workshops, seminars and conferences, consultations on important health issues, exchanges of scientific data and materials, and other biomedical communications. The cooperation encompassed both basic and applied research, ranging from highly sophisticated work in molecular biology to studies directed toward improved delivery of health services. Key areas of cooperation are infectious and parasitic diseases, prevention of blindness including nutritional aspects, child growth and development including low birth weight, mental health and substance abuse, reproductive physiology, cancer, neurologic and metabolic disorders, and others.

Financing for the program during the past two decades has come largely from the Special Foreign Currency Program (SFCP). Currently, estimated FY 1986 support for the program includes $2 million in prior obligations under SFCP, $150,000 from the U.S.-India Fund for Cultural, Educational and Scientific Cooperation, $2.4 million in STI-related expenditures by the PHS; and $1.5 million in support for Indian scientists participating in visiting programs and in-kind support through U.S. agencies, the dollar value of which cannot be calculated. For example, U.S. agencies provide bench space for training Indian scientists, and the time and expertise of intramural scientists for conducting cooperative projects.

No data on the Indian resources invested are available. Several Indian governmental organizations are involved, some of which (e.g., the Indian Council for Medical Research and the Department of Science and Technology) operate their own grant programs. Some organizations (e.g., the Indian Council for Medical Research and the Council for Scientific and Industrial Research) have their own research laboratories, participating in the program. Thus, both grant funds and intramural resources are involved. A primary distinction is that the Government of India does not make awards to U.S. institutions, while the U.S. makes some awards to Indian institutions, in U.S.- owned Indian rupees.

All projects are subjected to peer review for scientific merit by both governments. Projects also are reviewed for protection of human subjects.

The most recent meeting of the Indo-U.S. S&T was held in September, 1986. A joint Health, Medical and Life Sciences Working Group met as part of the Subcommission meeting. This meeting provided an important opportunity to review overall progress, and to discuss priorities and plans for future cooperation.

Projects are reviewed throughout their duration on the basis of progress reports, publication of results in the scientific literature, and presentation of results in appropriate international fora.

This program is expected to continue for many years, although its magnitude is always subject to available funding in both countries, periodic shifts in national leadership, and changes in emphasis.

Japan

DHHS bilateral relations with Japan in the health field are encompassed by several distinct agreements or arrangements. These include a Cooperative Medical Science Program, Cooperative Cancer Research, a MEDLARS Agreement with the National Library of Medicine, Vision Research, Cooperation in Research and Development in Science and Technology, and Gerontology.

Numerous benefits have accrued to U.S. health science through these relationships. A few examples are listed below.

1. A cooperative U.S.-Japan study identified a blood factor that is a surface antigen for hepatitis B virus. This breakthrough study was the starting point for a program to eradicate post-transfusion hepatitis B in the U.S. and Japan.

2. Cooperative studies were initiated on mutagens and carcinogens in foods following the discovery by Japanese scientists in 1976 that mutagens are formed during cooking.

3. Tremendous progress has been made in Hansen's disease (leprosy) research. This includes the development of effective therapeutic regimens for the disease, and considerable advances toward the development of an effective vaccine.

Under the S&T "non-energy" agreement, cooperation with Japan provides unique opportunities to explore how environmental and genetic factors interact to influence the risk of coronary heart disease, stroke, and hypertension. Morbidity and mortality trends for these conditions vary significantly between the two countries, and are a focus of major research interest.

Great progress has been made in the area of environmental health. Cooperative work has led to the development, validation, and utilization of short-term assays for evaluating the mutagenic and carcinogenic potential of natural and synthetic chemicals in the environment. These assays are now being used in large-scale screening programs in both countries.

Each country is responsible for providing the necessary financial support for its own scientific work.

Kuwait

The agreement between DHHS and the Ministry of Public Health was renewed for a second five-year period in May, 1986. The agreement recognizes the desire of the Ministry to gain information about technical skills and health resources in the U.S., and PHS agreed to cooperate with the Ministry in this endeavor. Identified areas of emphasis include development of health manpower, health care delivery, and management of health services.

Experts from PHS and U.S. academic and other non-government organizations may provide short-term technical assistance to the Ministry. PHS will aid the Ministry in identifying and obtaining this form of assistance.

The Ministry of Public Health will fund directly the costs of cooperative technical activities agreed to by both sides.

Activity under the Health Agreement has greatly decreased over the last few years since the Kuwaiti government implemented expenditure constraints due to the precipitous drop in petroleum prices. However, the Ministry believes that the level of activity in the future will increase. The Health Agreement was renewed to maintain an effective relationship between the U.S. and Kuwait.

Spain

PHS is a major participant in the U.S.-Spain S&T Program under an agreement it signed with the U.S.-Spain Joint Committee for Scientific and Technological Cooperation on November 4, 1984. In the health sector, the PHS provides for a U.S. review of the scientific merit of collaborative research proposals and progress reports that are combined with corresponding recommendations from the Spanish Section by the Joint Committee for bilateral decisions. This unique program supports collaborative research for a maximum of three years with a total of $200,000 per project. Unlike most other programs, it provides direct support to research laboratories in both countries. The Spanish and U.S. principal investigators use the funds to build on existing domestic research support, to facilitate the sharing of information, samples and data, and to pay for research assistants, small equipment, and travel related to the bilateral aspects of the research. In the health area, approximately 25 awards have been made for a total support of $4.4 million, all coming from the S&T Cooperation program. Most of the research projects are now in their second year of support. New awards will depend upon the outcome of renegotiation of the U.S.-Spain Agreement of Friendship, Defense, and Cooperation.

This program has been instrumental in developing good relations and better contacts between PHS and the Spanish Ministry of Health and Consumer Affairs. It also has provided a key mechanism for U.S. and Spanish non-governmental scientists to work together.

USSR

The National Security Council authorized DHHS during the past year to resume high-level contacts, which had not occurred since 1979, and to "reinvigorate" cooperation under the Health and Artificial Heart Agreements.

The Surgeon General from PHS and the Director of CDC visited the Soviet Union in early October to discuss new initiatives in public health, and to establish an agenda for the Eighth Meeting of the Joint Committee being held in April, 1987 in Washington. The Director of NIH and a delegation of senior biomedical research administrators visited the Soviet Union in November, 1986 to further identify areas of mutual interest and benefit for cooperation, and to prepare for the Joint Committee Meeting.

Collaborative research and exchanges at the working level have proceeded at a reduced, but steady, level for the past seven years. This involved exchange visits of 33 U.S. scientists and 38 Soviet scientists during 1986 for approximately 13 and 33 person/months, respectively, under the ten areas of defined cooperation.

Each side uses its own resources to fund the research conducted in its own country, transport its scientists to the other country, and host visiting scientists. The PHS does not specifically set aside any funds for U.S.- Soviet collaboration. Instead, each activity and exchange is judged on the basis of its merits, and competes with other domestic and foreign research proposals. This assures that the collaborative activities, as judged by each participating agency, are in strong support of their domestic health mission. For example, in the area of cardiovascular diseases, collaborative studies on risk factors are being conducted as well as basic research on the heart, biobehavioral studies of hypertension, and sharing of data on the clinical treatment of advanced coronary heart disease. Priority areas in cancer have been reassessed to focus on carcinogenesis, treatment and prevention through exchange of scientists for specific collaborative projects. There have been approximately 120 exchange visits over the past 12 years in the area of influenza, acute respiratory diseases, and viral hepatitis. These exchanges have allowed scientists from CDC to rapidly share information, viral strains, and data with Soviet counterparts, increasing mutual understanding of the epidemiology and means of controlling epidemics of influenza viruses and other infectious diseases.

Post Chernobyl Health Activities. Following the Chernobyl nuclear reactor accident on April 26, 1986, President Reagan offered humanitarian and technical assistance to the Soviet Union. A sub-group of the Interagency Chernobyl Task Force under the chairmanship of FDA was organized to address the human health implications of the accident. Dr. Robert Gale, a University of California, Los Angeles physician, led a team that, in conjunction with Soviet colleagues, performed bone marrow transplants on several victims of severe radiation exposure. Several government agencies and the National Academy of Sciences have expressed interest in cooperative research on the long-term environmental and health effects of large-scale radiation release. Under the proposals put forward, the extensive U.S. data base on health and environmental impacts of radiation exposure would be shared with the hope of adding data from the Chernobyl accident.

It is not clear at the end of FY 1986 whether cooperative ventures will be undertaken or their scope, should they receive the go-ahead by both countries. The Soviets had not accepted any of the U.S. proposals, but they stated that any cooperation on health effects must be done under the auspices of the U.S.-Soviet Union bilateral health agreement. Planned visits to the Soviet Union in November and December, 1986 by NIH and NRC delegations may bring progress on these proposals.

Chapter 10 - OCEANS AND POLAR AFFAIRS

Oceanography is entering the most exciting period in its history. The investments of the past have provided a scientific and technological foundation upon which the U.S. can aggressively build for the future in terms of food, health, energy, safety, minerals, long-range weather/climate and ocean forecasting, and a better understanding of the earth's processes. Consideration of just some of the current scientific and technological capabilities highlights a variety of potentially advantageous uses of new oceanographic knowledge.

Scientists, using ships equipped with multibeam acoustic mapping devices, deep-diving manned submersibles, and remote controlled vehicles now are able to examine in fine detail the processes that create and move the continents. In some active areas of crustal formation at the sea floor, new life forms have been discovered that are not dependent upon photosynthesis. Unlike the rest of the world's biota, these communities depend upon chemosynthesis, a process in which the energy for biosynthesis is not sunlight but chemical energy stored in reduced chemical compounds. Perhaps most exciting is that scientists are examining the hypothesis that these areas may have been the origin of life itself on this planet.

The oceans, either directly or through interaction with the atmosphere and other aspects of the planet earth system, affect the daily life of everyone, even people living far from the sea. Nature provides a bounty of food, materials, and amenities from the sea that are essential to humans. However, the oceans are intimately involved in long-term climatic changes and more immediate threats to human safety such as droughts and floods, foul weather and storm surges, and tsunamis created by sea floor earthquakes and volcanic eruptions.

Modern civilization and its technology have allowed humans to become active participants in the future of their planet. Through agricultural practices, energy consumption, and the use of natural resources of the land and sea, people are contributing to changes in the environment on a global scale with profound, yet largely unknown consequences. Advanced measurement capabilities are being developed in a global observing system, including both satellite and in situ observations to yield the necessary understanding of the system's processes. The data is being calibrated to document global change over several decades, leading to a data base for scientific understanding, prediction, and decision-making in order to respond to the consequences of global change.

Many agencies of the United States Government, plus academia and industry, are involved in the global effort to master our planet's system. These include NOAA, NSF, Navy, NASA, and a host of others, including other nations. The issues are global, their causes are global, and their resolution should be global. The oceans and atmosphere and other elements of the planet earth system recognize no boundaries established to order mankind's affairs. Collaboration among scientists is essential in defining approaches to the necessary understanding of how the planet earth system functions. Collaboration among governments is essential to facilitate the exchange of data and access to territorial and national ocean zones, and to mount the global scale programs that are required.

Some of the necessary international framework is in place, through such media as the Intergovernmental Oceanographic Commission (IOC) and the World Climate Research Program of the World Meteorological Organization (WMO), and discussions for augmenting this framework are underway in various intergovernmental and scientific fora. Under the Tropical Ocean/Global Atmosphere (TOGA) Program, now in progress, scientists see real hope for understanding cataclysmic events like monsoons and "El Nino" that affect the lives of millions of people.

The U.S. has continued to contribute its scientific and technological strength to the expansion of knowledge about the ocean, as such information makes important contributions to the U.S. national security and the quality of human life. Benefits of ocean research affect aspects of food, minerals, health, commerce, weather and climate prediction, and history (e.g., the wreck of the Titanic). The ocean as the last global frontier covers over 70 percent of the planet's surface; its depth and breadth challenge our ability to comprehend and apply knowledge of its processes.

It is impossible within a single chapter of this report to give a complete picture of all international ocean S&T efforts currently underway. This chapter provides instead an update that, in conjunction with past reports, presents a fairly comprehensive view of marine and polar S&T.

Global Ocean Observations - Climate and Sea Level

Increased global ocean observations conducted to understand the combined atmosphere-ocean system have improved weather forecasting over both ocean and land areas and man's ability to comprehend global environmental change. The integration of satellite and *in situ* oceanographic/atmospheric measurements (e.g., water level, winds, temperature, etc.) in real time through satellite communication has provided a complementary and relatively new means for monitoring ocean phenomena.

The U.S. actively participates in several international organizations, such as WMO, IOC, and the United Nations Environment Program (UNEP), to collaborate in understanding the ocean and its interaction with the atmosphere. Global programs of these organizations include the WOCE and TOGA programs. Cooperative agreements covering regional and global ocean monitoring are carried out with countries such as France, the USSR, the People's Republic of China (PRC), and Japan. These activities augment and complement the capabilities of the U.S. to provide ocean observations.

World Climate Research Program (WCRP)

The First Implementation Plan for the WCRP was published by the Joint Scientific Committee (JSC) for the WCRP in November, 1985. This plan served as the basis for discussions by an Informal Planning Meeting on the WCRP in May, 1986 at Geneva. The meeting demonstrated even greater international support for the WCRP than previously had been expected.

Eighteen nations pledged resources for data collecting, data processing, and numerical modelling for TOGA. The meeting also called for establishment of an intergovernmental board for TOGA to provide continuing intergovernmental consultations with respect to this program. The WMO later endorsed the proposal and set up such a new board.

Tropical Ocean/Global Atmosphere (TOGA) Program

The TOGA Program as part of the WCRP now involves fifteen countries. This ten-year study of interannual variability of the tropical oceans and global atmosphere that began in 1985 will lead to better real-time assessment of larg-scale climatic variations, such as "El Nino", monsoon variability in Asia and Africa, and droughts in Africa and South America. TOGA/WCRP will eventually enable countries to model, and therefore predict, these global variations. An International TOGA Board has been created to coordinate this global research effort.

ATLAS thermistor moorings developed by NOAA recently were deployed in the equatorial Pacific. The ATLAS arrays for the first time allow the U.S. to observe temperature variations that are needed to predict future climatic events such as "El Nino". ATLAS thermistor moorings provide real-time measurements of air and sea surface temperature, subsurface temperatures down to 500 meters, and surface winds; these data are transmitted to shore via the Argos satellite.

NOAA develops and operates the shipboard environmental acquisition systems (SEAS) program. Real-time observation/dissemination SEAS systems are deployed on U.S. Government research ships and other ships-of-opportunity from such countries as Australia, Canada, China, Japan, and Portugal. Data gathered currently support the TOGA program. All global data are archived and considered a valuable national resource.

An international TOGA Project Office (ITPO) has been established to support the ongoing planning of the TOGA Program, as well as the international coordination of activities contributing to the implementation of TOGA. The ITPO will assist the IOC/ICSU Committee on Climatic Changes in the Ocean (CCCO) Secretariat and the Director of the WCRP in the planning of TOGA.

Benefits

Use of a global observation network of oceanographic/meteorologic data and products benefits both the U.S. and the international community. The benefits are realized by in situ ocean observation and, by taking advantage of all available satellites, cooperating internationally to improve ocean models and oceanographic research. This resource will help the U.S. evaluate past global phenomena and be better able to predict, and thus prepare for, long-range adverse environmental impacts.

Living Resources

A number of programs and projects underway or launched in FY 1986 deal with the oceans' living resources. Some of these research activities fall within the Intergovernmental Oceanographic Commission's purview, while others dealing with fish and seafood resources tend to be associated with international fisheries arrangements. They are grouped together here for discussion purposes.

Sardine-Anchovy Recruitment Project (SARP)

A major unsolved problem in fisheries is what causes the great fluctuations within fish populations. A prime example of this phenomenon was the virtual disappearance of the Pacific sardine in the late 1940's and early 1950's, leading to studies of the causes of the decline. In a joint effort to deal with this basic fisheries problem, it was decided early in 1986 that the National Marine Fisheries Service (NMFS) Southwest Fisheries Center at La Jolla, California will be principal co-investigator with the Instituto Espanol de Oceanografia in SARP conducting a comprehensive study of sardine recruitment off Spain.

The objective of the program, sponsored by the U.S.-Spain Joint Committee on Science and Technology, is to study various aspects of the sardine and anchovy populations off northwest Spain. One major avenue of investigation will be the application of the egg production method devised by fishery biologists at the Southwest Fisheries Center for the purposes of biomass assessment. In this method, the number of eggs produced in any one night by a population of fish is related to the fecundity and frequency of spawning that occurred during the same period.

SARP is sponsored world-wide by IOC and the Food and Agriculture Organization of the U.N. as part of an overall program entitled "Ocean Science in Relation to Living Resources" (OSLR).

Discussions also were held during 1986, between NMFS and the Instituto Nacional de Investigacao das Pescas of Portugal on collaboration on SARP research, and some preliminary activities were begun. Spanish and Portuguese scientists also discussed collaboration on SARP. While not a formal trilateral program, this three-way collaboration will enhance the benefits from SARP research for all three countries. During 1986, NMFS also continued its collaboration on SARP with Mexico, Peru, Ecuador, Chile, Brazil, and Argentina.

Ocean Science in Relation to Living Resources (OSLR)

Discussions have continued on development of other projects within the overall OSLR program. A second major project was approved in 1986, the Tropical Demersal Recruitment Project (TRODERP). An IOC-FAO Workshop entitled Recruitment in Tropical Coastal Demersal Communities was hosted in April by the Universidad Nacional Autonoma de Mexico and the Secretaria de Pesca de Mexico. Demersal (i.e., bottom and near-bottom dwelling) resources have major socio-economic and scientific importance in the coastal regions of the tropical oceans in many parts of the world.

In contrast to the low-diversity pelagic (i.e., open ocean and near-shore) fish communities that are the focus of SARP, these tropical demersal communities are systems of very high diversity where a single trawl haul may comprise several dozen species. Population abundance and resilience to exploitation are contingent upon recruitment rates that are dependent upon complex and tenuous linkages of life cycle events to fluctuating environmental processes. Recruitment studies in the field are complicated by the presence of eggs and larvae of numerous species that often are unidentifiable at the species or generic level. Important but complex ecologic questions must be addressed, such as the effects on recruitment of desirable species (i.e., shrimp). The initial TRODERP focus is on recruitment processes associated with tropical shrimps and prawns, coral reefs and similar 'hard bottom' tropical communities, and 'soft bottom' tropical communities, with particular reference to linkages with estuarine processes.

TRODERP does not have the same requirement as SARP for a large minimum effort to accomplish a unit experiment. The great number and diversity of tropical habitants offers rich opportunities for application of the comparative scientific method whereby interregional coordination of efforts of various magnitudes, smaller than SARP-size, is expected to yield progress on the recruitment problem over a broad scientific front. Moreover, TRODERP will offer the opportunity to participate in OSLR to many more developing countries, most of which are found in the tropical regions. Based upon the broad scientific discussion at the workshop in Mexico, efforts now are being considered or are underway to plan specific TRODERP projects in a number of areas including the Indian Ocean, the Western Pacific, and the Western Atlantic extending from the Gulf of Mexico to northern Brazil, a region of particular interest to the U.S.

International Fisheries Commissions

International Fisheries Commissions have not been discussed in this report for several years. There are a number of reasons for this. One is that the primary function of IFCs is fisheries management, not science, although research is an important function of several commissions. Another is that due to the nature of fisheries research there are seldom if ever breakthroughs or discoveries sufficiently remarkable to attract attention in this annual report. Rather, fisheries research generally is slow, painstaking work that gradually improves the knowledge and ability to apply it to management problems in an incremental process.

The research activities in this field vary widely from commission to commission; some engage in in-house research such as the Inter-American Tropical Tuna Commission, while others have a limited scientific capability on their staffs that augments the coordination functions among their member countries' research efforts, such as the International Commission for the Conservation of Atlantic Tuna. Still others provide only a forum for the coordination of research by the members, such as the International North Pacific Fisheries Commission.

Also included in the IFC budget of the Department of State used for U.S. membership contributions or dues to the IFCs are funds for the International Council for the Exploration of the Sea (ICES), a non-IFC in that it performs no management functions. ICES is a research organization that primarily coordinates international research activities and makes recommendations to its member nations in the North Atlantic region on a broad range of topics, primarily dealing with fisheries and marine pollution. ICES has a limited in-house scientific capability that augments the research coordination function. The scientific activities of ICES have been covered periodically in previous reports, and is mentioned in this chapter under "Multilateral Activities". Through its Advisory Committee on Fishery Management, ICES provides scientific advice utilized in management functions by a number of fisheries commissions. Scientific advice also is provided through the ICES Advisory Committee on Marine Pollution to a number of international marine pollution abatement and control agreements such as the London Dumping Convention, the Oslo Commission, and the Paris Convention.

The U.S. contributions during FY 1986 to the IFCs, including ICES, amounted to $10.8 million. This contrasts with the $8.0 million contributed in FY 1981; the increase primarily is attributable to inflation and the addition of new commissions including the North Atlantic Salmon Conservation Organization, the Commission for the Conservation of Antarctic Marine Living Resources (see "Antarctic" section) and the Pacific Salmon Organization.

South Pacific Tuna Accord

Agreement in principle has been reached with 16 South Pacific countries on the terms and conditions of access to their 200-mile fishing zones by the U.S. tuna fleet for a five-year period. Deputy Assistant Secretary of State, Edward E. Wolfe, initialed an agreement on October 20, 1986 at Tonga for the U.S. tuna industry to provide $1.75 million in license fees and $250,000 in technical assistance in the first year, and the U.S. Government will provide $10 million to assist the island nations' economic development. The U.S. expects a treaty to be ready for signature sometime in the first half of 1987.

Governing International Fisheries Agreements (GIFAs)

The U.S. has a GIFA, as required by U.S. law, with each of the 12 foreign nations allowed to fish in the U.S. Exclusive Economic Zone (EEZ). The purpose of these agreements is to promote effective conservation, rational management, and the achievement of optimum yield in the fisheries of mutual interest off the coasts of the U.S. These GIFAs also facilitate the rapid and full development of the U.S. fishing industry, and establish a common understanding of the principles and procedures under which fishing may be conducted by foreign nationals and vessels for the living resources over which the U.S. has sovereign rights to explore, exploit, conserve, and manage. Each of the GIFAs provides for cooperation in scientific research.

The GIFA countries cooperate in conducting scientific research for the purpose of managing and conserving living marine resources within the U.S. EEZ, including the compilation of the best available scientific information for management and conservation of stocks of mutual interest. This information includes biostatistical and fisheries data such as catch and effort statistics, and economic data requested by the U.S. These data and information are collected and reported using procedures and techniques approved and stipulated by the U.S.

The 12 GIFAs presently in force are with Bulgaria, the European Economic Community (EEC), Denmark/Faroe Islands, German Democratic Republic (GDR), Iceland, Japan, Republic of Korea, the PRC, Poland, Spain, Taiwan, and the USSR.

Multilateral Activities

While the U.S. undertakes much marine scientific research on its own, multilateral and bilateral cooperation is essential to oceanic research due to the immense size of the ocean and the broad extent of the infrastructure often required for particular projects or topical research. The cooperation takes many forms including international organizations at both the scientific and governmental levels, formal programs of various kinds, and many informal collaborative efforts. These activities offer opportunities to enhance U.S. and foreign research of mutual benefit, and to foster good will and understanding among participants from many nations. There are too many activities to cover in one chapter, but this section and the following one on Bilateral Cooperation give a representative sampling to augment the other topic-specific sections.

Intergovernmental Oceanographic Commission (IOC)

IOC is the only global organization exclusively devoted to marine scientific research. IOC works closely with numerous other global and regional bodies such as WMO, FAO, UNEP, and ICES on formal and informal cooperative efforts. Some of the more recent and innovative programs it is involved with, such as SARP and WCRP are covered or updated elsewhere in this chapter. Although the fiscal crisis in UNESCO curtailed IOC activities during 1986, there are other significant developments.

Pollution. The Global Investigation of Pollution in the Marine Environment (GIPME) is a well-established IOC program with a solid record of accomplishments that continued through 1986. For example, a September workshop at Oslo sponsored by IOC and NOAA took an international look for the first time at the best way to measure the biological effects of pollution, that is, the basic processes involved in determining what a measurement means. The very successful workshop also considered how results from various methods could be interrelated. A group of experts on standard reference materials was formed with UNEP as co-sponsor, part of a general increase of UNEP co-sponsorship of GIPME activities. NOAA prepared a loose-leaf catalogue for IOC distribution listing all available standard reference material, in response to an identified need for standards in ocean pollution measurements. This also will be used in basic marine geochemical research. Other participants include the National Bureau of Standards and the Environmental Protection Agency from the U.S. and comparable experts from Canada, Japan, and Belgium.

Another successful workshop was held at Bangkok for training in the study of river inputs to the coastal oceans, that focused particularly on the flow of suspended particulate matter into the Gulf of Thailand. The workshop, the first of its kind in the region, complemented an NSF-supported research project on river inputs to the coastal ocean. Local trainees are now following through by taking measurements of the particulate flow.

Another profitable GIPME activity in 1986 was a training workshop in November in Mexico that also was co-sponsored by UNEP. The workshop focused on measurement of pollutants in sediments and bivalves, and launched a "mussel watch" project for the Caribbean in which Mexico, Venezuela, Costa Rica, Colombia, the U.S., and others are participating. The various "mussel watch" projects throughout the world are simple and effective ways of monitoring the extent of marine pollution and its bio-accumulation.

Data Exchange. The International Oceanographic Data Exchange (IODE) program is the IOC's longest-standing program, and one in which the U.S. traditionally has played a major role. IODE serves an important international need and directly serves U.S. interests. Over 70 percent of the U.S. National Oceanographic Data Center's major data bases were obtained through the IODE system. Similarly, holdings of foreign-source bathymetric data at the U.S. National Geophysical Data Center, much of it obtained through IOC, constitute a significant portion of the U.S. bathymetric data base. Duplication of this data by the U.S. would have been enormously expensive (in excess of a billion dollars to collect) and some of it otherwise would not be available except through IODE.

IOC also prescribes common formats and standards that enhance the value of bilaterally and multilaterally exchanged data. IODE contributes to all IOC scientific research and service programs. It also includes a substantial and valuable marine information capability dealing with topics such as oceanography, fisheries research, and marine environmental protection and research activities. The receipt of data by the World Data Center A at Washington through World Data Center B at Moscow has proved to be the only reliable mechanism for acquiring Soviet and Eastern Bloc oceanographic data.

IODE focused on improvements in the system during 1986 for WCRP and other planned global research programs. The IOC Working Committee for IODE plans to meet at Moscow in December, 1986.

Western Pacific (WESTPAC) Program. The IOC Western Pacific Program remained active in 1986 through a number of specialized groups and workshops, and remained responsive to U.S. interests in the region. The Task Team on Marine Pollution Research and Monitoring has met regularly in recent years and produced a draft manual on techniques in this area. The Task Team on Red Tides also has been active. Another task team is promoting collection and exchange of real-time and quasi-real-time data in the region. Australia particularly has been active in the program, and hosted the WESTPAC Symposium on the Indo-Pacific Convergence Zone in December, 1986. The next meeting of the IOC Program Group on WESTPAC is planned for Thailand in 1987.

International Council for the Exploration of the Sea (ICES)

In addition to IOC, which operates on a global scale, the U.S. participates in a number of regional organizations that conduct, promote, or coordinate important marine research activities, including a host of international fisheries commissions. Perhaps the most important of these is the ICES that functions in the North Atlantic region (also see the previous discussion under IFCs. ICES, founded in 1899 as the first international ocean organization, has taken a very dynamic approach to marine research problems, particularly in the last decade under leadership provided by Americans and younger scientists from other members nations. During 1986 ICES emphasized the review and development of monitoring techniques for biological effects of marine pollution. With input from the U.S., ICES continued its coordinated monitoring of contaminants in habitants and tissues of important commercial and recreational species.

ICES also continued to promote the development of habitat assessment that indicates the relative quality of fisheries habitats in the Northeast and Northwest Atlantic, and ancillary estuarine waters. The U.S. continues to contribute significantly to habitat issues and to committee endeavors concerned with the distribution, abundance, and biology of key fishery resources and supporting food chain organisms.

South Pacific (SOPAC) Research Program

SOPAC is an intergovernmental body that receives funding from its 11 member nations in the region, and from supporting nations including the U.S. The SOPAC Committee and its supporting Secretariat serve to foster and integrate research and resource investigations in the South Pacific region. In 1987, ships from France, FRG, U.K., Japan, U.S., and possibly the USSR will work in the region.

Under a trilateral component of SOPAC, a major USGS activity in 1986 continued to be data processing and report writing associated with the 1984 geophysical surveys. The mineral resource exploitation part of the program is being conducted by the Hawaiian Institute of Geophysics. Their 1985 and 1986 seabed surveys will be processed and the results presented in 1987. Up-to-date results of these investigations were presented to international oil and mineral companies at the Circum-Pacific Council for Energy and Mineral Resources meeting that was held in August, 1986 at Singapore. Additional interest in the resources of the region is indicated by the fact that the American Association of Petroleum Geologists has sold more than 325 copies of the volume "Geology and Offshore Resources of Pacific Island Arcs - Tonga" that summarizes USGS surveys in the Tonga region.

Other components of the SOPAC program are workshops on coastal geology, the stationing of a USGS geologist in the region, support for the SOPAC Technical Secretariat in Suva, and support for the education of a Solomons Island geologist in the U.S.

The U.S., in concert with Australia and New Zealand, proposes to continue the Tripartite Program in the SOPAC region when the current agreement expires in 1987. All three nations recognize that U.S. financial level of commitment to the program will be substantially reduced and will not provide for follow-on geologic and geophysical surveys.

Ocean Drilling Program (ODP)

ODP is a ten year program of worldwide ocean drilling to provide fundamental information about the history of the world's continents and ocean basins, about the earth's changing environment, and about the evolution of life. In addition to NSF, six international members (i.e., Canada, France, FRG, U.K., Japan, and a European Science Foundation consortium) support the scientific program that has succeeded the successful Deep Sea Drilling Project (DSDP). ODP started operation in early 1985. In 1986 six drilling legs were successfully completed, including work in the Mediterranean, coastal regions off Northwest Africa, the central Atlantic, Barbados margin, and regions off the west coast of South America.

Drilling is planned eventually in all of the world's oceans. The drill ship JOIDES RESOLUTION will operate in the Antarctic, the southern Atlantic, and the Indian Ocean during the next year. Foreign participants are expected to contribute 47 percent of expected ODP costs over the period 1985 to 1994.

Bilateral Cooperation

Spain

Marine science is the third largest activity under the U.S.-Spain Joint Committee for Scientific and Technological Cooperation (see Chapter 4). With the approval of four additional research projects in 1986, there now are eight bilateral marine research projects underway within this program. Two additional marine science seminars also were approved, bringing the total to four held in this field in a little over a year. The research projects and seminars were allotted over $3.0 million that otherwise would not have been available for marine research during the current agreement period.

The projects over a range of topics, including physical and biologic oceanography, fisheries, chemistry, geology, and marine engineering. Although all of the projects are one to several years from completion. Promising results already have been reported in several of them, including the relationships between fish and their environment, aquaculture, and red tides and the production of marine toxins.

The similarity of oceanic conditions off Spain and the U.S., coupled with the high quality of marine scientists and the extensive marine science infrastructure in Spain, naturally promotes cooperation between the two countries. Scientists in both countries have displayed a vigorous enthusiasm for the program. One of the seminars last year resulted in approval this year of a SARP project (see Living Resources in this chapter) extending far beyond the bilateral efforts involved. Another topical seminar conducted in September, 1986 proved useful to the participants and opened the possibility of further collaborative research on various phases of the effects of parasites and diseases on commercially important shellfish.

In June 1986, a general marine science seminar was held for the first time to discuss a broad range of on-going research activities, not limited to the formal U.S.-Spain S&T Program. Possibilities for future projects also were discussed. The exchange of information and the groundwork for possible future projects covering a wide range of topics were so successful that participants urged creation of a permanent series of such general marine science seminars to augment and reinforce the cooperative research projects and the topical seminars.

The U.S. and Spain also are actively working together in a number of other marine science projects, some of them multilateral, such as the Western Mediterranean Circulation Experiment, the Physical Oceanography of the Eastern Mediterranean (POEM) program supported in part by IOC, and the Gibraltar Experiment on the currents and other physical oceanographic phenomena that are important to transit through this strategic strait.

People's Republic of China

The U.S. has agreements with the PRC relating to oceans and atmospheric sciences. A wide range of activities continues under these. Of particular note was a joint U.S.-PRC research cruise during 1985 and 1986. This joint venture was conducted at significant cost savings to the U.S., and will produce data for both operational climate analysis and research including development of climate prediction models as part of the TOGA program.

United Kingdom

Efforts to further develop plans for a Global Ocean Flux Study (GOFS) were expanded through extensive interaction between U.S. and U.K. scientists, especially at a GOFS Symposium organized by the Royal Society in February. Other cooperative activities included a GOFS planning meeting convened just following the Symposium by the Natural Environment Research Council (NERC) of the U.K.; and a GOFS Workshop in July at the University of Bristol. U.S. scientists participated in these meetings, made presentations on relevant U.S. activities, and encouraged joint planning for future GOFS activities.

A Memorandum of Understanding (MOU) pertaining to the exchange of offshore oil and gas technology has been in existence for several years between the U.K. Department of Energy and the Interior Department's Minerals Management Service (MMS). Under the aegis of this MOU, information has been exchanged on subjects such as offshore operational risk analysis and the metallurgical behavior of high strength steels in sea water.

Canada

A MOU between the MMS and the Canadian Department of the Environment, Conservation and Protection (CP), covers cooperation and cost sharing on research pertaining to the offshore prevention and recovery of spilled oil. CP has contributed approximately $50,000 during FY 1986 to an MMS project that is examining the prospects for burning oil slicks on the open ocean.

MMS is providing partial support for Canadian projects that quantify the capability of oil spill booms to collect oil, and oil spill additives to facilitate the collection. The MMS spent approximately $130,000 to fund such Canadian projects during FY 1986.

CP has been actively engaged in offshore oil spill research for nearly two decades and is an international authority on the technology. For the past ten years, it has been a funding participant in an interagency committee that directs U.S. Government testing of oil spill response equipment and procedures.

USGS cooperated with the Geological Survey of Canada during 1986, and initiated a geophysical program in the Great Lakes. The $1 million effort is focussed at understanding the deep crustal structure under Lake Superior, Lake Michigan, and Lake Huron. Seismic surveys were conducted in the summer of 1986, and 1987 will be spent processing data. A final report on the work is planned for 1988.

Japan

A panel on aquaculture, one of seven marine panels under the U.S.-Japan Cooperative Program in Natural Resources (UJNR), has met five times since 1981--twice in Japan and three times in the U.S. Topics discussed have included salmon enhancement, environmental quality in aquaculture systems, new and innovative advances in biology/engineering in aquaculture, and reproduction, maturation, and seed production in aquaculture. The U.S. sent nearly 610 publications to Japan during the last four years, and the Japanese side sent nearly 460 publications to the U.S. Five cooperative projects in other areas were carried out directly involving American and Japanese scientists in the registering of marine pathology, sea ranching of clams and salmon, transplantation of Japanese clams to Puget Sound, and disease resistance of U.S. oysters in Japan. The exchange of information and technology, and cooperative projects on fish/shellfish culture and enhancement, continue to provide significant benefits to industry and public agencies.

U.S. scientists and engineers continued to cooperate with Japanese colleagues during 1986 on various other projects. The 14th biennial meeting of the U.S.-Japan Marine Facilities Panel, a UJNR component, focused on facilities for ocean research and development, undersea technology and systems, advanced ship technology, coastal development/ocean space utilization, ocean measurement systems, and waste management systems. Valuable exchanges of information took place.

Japanese and U.S. ocean scientists met during a workshop in March 1986 to began planning joint scientific efforts in support of [illegible] World Oceans Circulation Experiment (WOCE) being considered for possible future implementation. Participants agreed to begin efforts on a number of WOCE-related activities, especially with respect to future development of needed WOCE data management systems and exchange of information on WOCE technology developments.

New Zealand

New Zealand scientists aboard their research vessel, KAHAROA, conducted cooperative oceanographic and biological studies in the South Pacific in February, 1986 with scientists NOAA/National Marine Fisheries Service aboard the NOAA Ship TOWNSEND CROMWELL. The objective of the joint project was to obtain information on the biology, ecology, and population dynamics of albacore tuna in the South Pacific, of interest to both nations as a potential fisheries resource. A further goal of the study is to gain experience for evaluating the feasibility of developing a U.S. troll fishery for albacore that would operate during January through May and be centered about 1,500 to 2,000 miles southeast of American Samoa.

Data were collected on the physical and biological characteristics of the ocean environment associated with high concentrations of albacore, as well as on the distribution and availability of albacore in the surface waters of the subtropical convergence zone of the South Pacific. Whenever feasible, the survey strategy of the CROMWELL was integrated with that of the KAHAROA. In addition, two U.S. commercial fishing trollers conducted exploratory fishing, made oceanographic observations, and tagged albacore. Scientists from France, Tonga, and New Caledonia also cooperated in this international survey.

Based on the survey, NMFS fishery biologists believe that the prospects for establishing a U.S. albacore fishery in the South Pacific appear favorable. Analysis of the data collected by the NMFS and New Zealand scientists show the South Pacific albacore population to be in good condition, capable of supporting a surface fishery. More fishery exploratory surveys and knowledge of the migration patterns and biology of the population are required before a viable U.S. albacore fishery in the South Pacific can be successfully developed.

India

The U.S.-India Fund (USIF) supports joint Indo-U.S. scientific, educational, and cultural projects. Fund allocations in rupees are made by the Department of State in cooperation with USIA. NOAA obtained USIF support for two projects in solar-terrestrial physics that began late in FY 1986.

While a broad Indo-U.S. cooperative marine science program is in its early developmental stages, a project on bioactive substances from the Indian Ocean has been actively underway since January, 1985. Extensive work has taken place in this field in the Atlantic and Pacific Oceans, and in the Mediterranean Sea, but very little had been done in the Indian Ocean prior to this project. Three institutions from each country are supported by the Office of Naval Research (ONR) in the U.S. and the Council of Scientific and Industrial Research in India. The project involves collecting marine plants and animals from Indian waters and studying the organic compounds that they contain. The scientists are not only searching for pharmaceutical activity such as antifertility or antibiotic activity, but are also investigating the roles of these materials in the ecology and behavior of the marine organisms that produce them. Under the program, four Indian scientists received training in the U.S. in diving and collecting techniques. Nearly 200 samples have been collected to date and examined in India, and a number of samples have been sent to the U.S. for advanced chemical analysis.

S&T constitute a large part of the relationship between the U.S. and Indian governments. There have been indications since 1984 that the Indian government welcomes participation of NOAA in joint Indo-U.S. atmospheric and marine research. Cooperation with India could enlarge the data base available to the TOGA program. Several atmospheric and marine science programs were considered briefly at a meeting of the Indo-U.S. Science and Technology Subcommission on September 22 to 24, 1986. Priorities among these programs are being set jointly by the Indian and U.S. governments. USIF support will be sought for the highest priority programs.

ONR also sponsored an international conference at Goa in January 1986, on Marine Biodeterioration in the Indian Ocean. Participants included approximately 30 U.S. and 80 Indian scientists, and scientists from four other countries. A proceedings volume is being prepared and will be published, and a program plan was prepared for Indo-U.S. cooperative research in marine biodeterioration that presently is in India's approval process; if approved, this program will be supported by USIF.

ONR together with NBS initiated a major Indo-U.S. cooperative research program in materials science. Launched in September 1985, it is scheduled to run for three years. Scientists from 20 Indian laboratories and ten U.S. laboratories and universities are taking part in the program. One of the 11 projects is a study of accelerated corrosion of marine alloys.

Pakistan

ONR supported a U.S.-Pakistani conference on marine science of the Arabian Sea in early 1986 from which which a proceedings volume is being produced. The conference participants also prepared a program plan for cooperative U.S.-Pakistani research on living resources of the Arabian Sea and western Indian Ocean that has received technical approval from the appropriate Government of Pakistan agencies. It is expected that at least ten projects are to be initiated involving the Pakistani National Institute of Oceanography and the University of Karachi. These will include a ship-of-opportunity project to regularly collect bathythermograph data in the Arabian Sea, and another to tie together physical oceanographic dynamics and biological productivity studies of importance to investigations of monsoons and upwelling activities. ONR and the participating American scientists also will be working on studies having a bearing on the economic potential of fisheries off Pakistan, including the life history of nearshore animals and systematics. Another project will focus on biodeterioration, the effects of woodborers in the mangroves, and perhaps studies of pollution along the Pakistani coast.

France

The U.S. and France have had a broad program for oceanographic cooperation since 1972. Under this program in 1986 an important agreement was established on mutual submersible rescue services. Under the submersibles project area of the bilateral agreement, the two sides have cooperated during the design and construction of the French 6,000-meter depth capable NAUTILE (SM-97), and the U.S. conversion of the DSV SEA CLIFF (DSV 4) to 20,000-foot depth capability. The agreement also involves development of a support plan that includes procedures for the transport, handling, and communications of submersibles.

At the Tenth review session for the program in November, 1986, a decision was made to begin planning for a joint project to study the geologic, chemical, and biological processes of the mid-ocean ridge system, at fast and slow spreading ridges, and the consequences of these processes on the oceans. A working group was tasked with the preparation of a preliminary action plan by March, 1987. Among other actions taken, a seventh subsection of the living resources and aquaculture panel on marine biotechnology was established.

USSR

The renewal of the World Ocean Agreement between the U.S. and the Soviet Union for a period of three years was cited in the previous annual report. However, no new activities have been undertaken, and there is at present no evidence of any substantial interest on either side in pursuing cooperative projects under this agreement at this time. Cooperation between the two countries does continue under the US-USSR Environmental Agreement, in fisheries research not falling under the World Ocean Agreement, and in various multilateral fora.

Antarctic Treaty and Antarctic Treaty System

A comprehensive review of the 1959 Antarctic Treaty and the system that has grown up around it, including a series of related arrangements that expanded the system into new activities such as the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) was included in last year's report. Negotiations have been underway for some years in an attempt to establish an Antarctic minerals resources regime. The past year continued to be an active one in the Antarctic system, including the fields of Antarctic marine living resources and Antarctic mineral resources.

Living Resources

The Commission and the Scientific Committee established by CCAMLR held their fifth annual meeting at Commission headquarters at Hobart, Australia in September, 1986, and made further progress in the assessment of the fishery resources in the Antarctic. An assessment working group incorporated new data for the purpose of providing updated and new advice on the status of the fish stocks. The Scientific Committee considered the new results and recommended that the Commission take further actions to restore depleted stocks, particularly around South Georgia. The Commission considered imposing catch restrictions on the fishery at South Georgia, but could not agree on reducing the fishing below last year's level. It was agreed, however, to consider catch limitations at the 1987 meeting. Based on the Scientific Committee's recommendations, the Commission agreed that members would report data on catch, effort, and biological characteristics of the commercial catch to the Commission annually.

A program development plan to support the scientific program of CCAMLR for the period 1986 through 1988 was submitted to Congress in June by the Department of Commerce in response to the Antarctic Marine Living Resources Convention Act of 1984 (P.L. 98-623). The U.S. program of directed research will focus on population assessments of krill, fish, marine birds, seals, and whales in relation to fishing (krill and fish) and variability in circulation and natural productivity of the Southern Ocean. Research during the FY 1987 austral spring will be conducted on krill biomass and fish stock assessments in the Bransfield Strait and South Georgia areas of the Scotia Sea. In addition, studies will be conducted on the reproductive success of penguin colonies and seal rookeries in the South Shetland Islands. All three studies are part of an integrated multidisciplinary NOAA/NMFS effort to assess the effects of conservation measures in accelerating the recovery of depleted fish stocks, and to improve estimates of the krill biomass supporting populations of fish, marine mammals, and birds in the Antarctic ecosystem. Other countries party to CCAMLR are engaged in similar research programs.

Mineral Resources

The Consultative Parties to the Antarctic Treaty continued negotiations in 1986 on the elaboration of a regime for mineral resources, looking toward the establishment of a regime comprising an international system to determine the acceptability of possible mineral resources activities. An accord would govern any such activities that are determined to be acceptable in Antarctica. During 1986, two further rounds of negotiations that had started in 1982 were held in Australia and in Japan; the next round is scheduled to be held in New Zealand in early 1987. Negotiations during FY 1986 continued to make progress on a number of difficult issues, with continued emphasis on protection of the Antarctic environment as a cardinal principle of the Antarctic Treaty system.

Mapping and Data Collection

USGS continued topographic and satellite image mapping of Antarctica in cooperation with counterparts in Australia, New Zealand, the U.K., and France. USGS also operates the Scientific Committee on Antarctic Research (SCAR) Library for Geodesy and Cartography. An index to Landsat satellite images of Antarctica was published; prototype Landsat image maps were prepared that demonstrate greater mapping capabilities of Landsat than previously perceived. A project was initiated to integrate and analyze geodetic observations from all nations.

During 1986, a 1:250,000-scale topographic reconnaissance map of Ross Island and vicinity (i.e., a 25,000 sq. mi. area) was published, and aerial photography was gathered for an ongoing photogrammetric project on ice dynamics in the Siple Coast area. Other 1986 projects included aerial photography over the Terra Nova Bay for polynya studies and over areas of Ross Island and vicinity for penguin population and aquatic biota studies, and collecting geodetic survey and gravity data in the Beardmore glacier area using conventional and satellite Doppler means. Work continues on integrating survey networks into a unified system. Over 5,000 more aerial photographs were indexed in the SCAR Library for Geodesy and Cartography, and approximately 40,000 more were acquired. Numerous foreign produced maps of Antarctica were obtained and distributed. Navigational satellites were tracked at the South Pole for ice-motion studies and to provide data for ensuring accurate navigational capabilities for merchant ships. Seismic data were gathered as part of the Worldwide Standardized Seismograph Network and for ultra-long-period seismic studies.

Planned projects for 1987 include aerial photography over the Siple Coast and on the Polar Plateau above Terra Nova Bay, and geodetic and gravity information gathering around McMurdo Sound, Ross Island, Minna Bluff, and adjacent areas. Geodetic data analysis will continue and portions of a unified network will be published. Work will continue with the U.K. on a 1:5,000,000-scale map of Antarctica. Approximately 25,000 square miles of satellite image maps and 6,000 square miles of topographic reconnaissance maps will be published. Reports and papers will be published on Antarctic geodesy, cartography, aerial photography, and remote sensing. South Pole activities will continue to include ice motion studies, geodetic data acquisition, seismic studies, computer operations, and satellite telecommunications operations. The SCAR Library will continue to be upgraded and aerial photographs will be entered into a computer indexing system.

During 1986, USGS released seismic reflection data from its 1984 survey of the Ross Sea. Aeromagnetic map preparation continued in cooperation with the FRG. New instruments for measuring Antarctic glacier ice thickness were designed and tested in the U.S. Antarctica's first digital seismic observatory was established.

Arctic Activities

USGS conducted cooperative airborne radar soundings of glacial ice thickness in Greenland; volcanic, geothermal, and glacial studies in Iceland; exchanges on mapping, digital cartography, engineering geology, and ice island studies with Canada; and joint studies of marginal sea ice with France, Norway, Canada, the U.K., and the FRG. USGS participated in the annual U.S.-Canada Beaufort Sea Development Conference at Washington during 1986, and also participated extensively in the implementation of the Arctic Research and Policy Act by conducting a public workshop on Arctic energy and minerals research needs.

The Marginal Ice Zone Experiment (MIZEX) is an ongoing project investigating extremely important factors of atmospheric forcing of ice movement, upper ocean mixing, and currents. MIZEX continued during FY 1986 to provide the first intensive mesoscale meteorologic observation in a Marginal Ice Zone region. Valuable meteorologic, oceanographic, and acoustic data were produced. The MIZEX experiment is being conducted in the Fram Strait, northwest of the Svalbard Islands.

International Whaling Commission (IWC)

A review of the IWC, the U.S. role and objectives, and the major decision of the IWC to adopt a moratorium on commercial whaling with a transition period, was contained in the previous report. A 1984 arrangement with Japan to end its commercial whaling had been pending the outcome of a lawsuit by environmental organizations that had been petitioned to the Supreme Court. In 1986, the U.S. Government successfully defended itself against this lawsuit. Following the Supreme Court decision, Japan notified the IWC that it was withdrawing its objection to the moratorium decision effective in 1988.

In 1985, the Secretary of Commerce had certified the Soviet Union for whaling in excess of IWC quotas for Southern Hemisphere minke whales. In the absence of any remedial action, and in the face of continued Soviet whaling under the IWC commercial moratorium, Soviet fisheries allocations were eliminated on April 1, 1986.

The Secretary of Commerce certified Norway on June 9, 1986 for exceeding the IWC zero quota for two stocks of minke whales in the North Atlantic Ocean. Norway does not fish in U.S. waters, and therefore, it did not receive a reduction in fisheries allocations. On July 3, 1986, the Government of Norway announced that it would suspend commercial whaling after the 1987 coastal whaling season. The foundation for the effectiveness of the IWC conservation program remains the voluntary compliance of member governments. The Norwegian decision contemplates compliance, even though delayed, with IWC zero quotas; therefore, the President did not impose sanctions against Norwegian fish products under the Pelly Amendment. The certification of Norway continues, however, until Norway withdraws its objection or the IWC authorizes the resumption of commercial whaling on stocks of interest to Norway.

At the 1986 IWC meeting, the Commission passed a resolution recommending guidance for countries deciding on the granting of permits for taking of whales for research purposes. Iceland and Korea submitted research programs to the IWC Scientific Committee in 1985, received comments, and resubmitted their programs to the 1986 meeting of the IWC Scientific Committee. Iceland received a favorable review of its proposed program and issued permits for the taking of fin and sei whales for research purposes. Following discussions with U.S. representatives, Iceland agreed to consume domestically 51 percent of the resultant whale meat and products as recommended in the IWC resolution. Korea did not provide complete information on its proposed research program, and did not receive a favorable review of its research program by the IWC Scientific Committee. Although Korea had issued permits for the taking of whales for research purposes, it suspended its taking at the request of the U.S. Government after harvesting only 69 whales. The U.S. IWC Commissioner has encouraged the Korean Government to work cooperatively with the U.S. and other IWC Commissioners to define better the linkage between research done under special scientific permits and the comprehensive assessment required to assess effects of the commercial moratorium on the status of whale stocks.

Office of Naval Research (ONR)

The Ocean Sciences Division of ONR covers the full range of disciplines from physical oceanography of the open ocean and coastal zones, through oceanic biology and oceanic chemistry, to marine meteorology. The objective of the division's research is to understand basic processes in, on, and over the world's oceans. The approach incorporates a combination of specialized observational instrumentation, detailed field studies, and theoretical investigations, all leading to the development, verification, and improvement of hypotheses to explain the evolution of the world's oceans and the atmosphere above them. In time, these hypotheses will be turned into predictive models for use by operational Navy forecasters on land and at sea. The program interacts extensively with other national and international efforts and primarily is rooted in the academic community. It makes use of private contractors and laboratories when specific requirements dictate; Navy and other government laboratories also are utilized.

Gibraltar Experiment

A good example of an international effort sponsored by ONR is the Gibraltar Experiment, part of a strategic straits study. It is designed to develop an understanding of the physical oceanographic processes at work in sea straits, and develop predictive models of these processes at appropriate temporal and spatial resolution. Currents, eddies, interaction between surface effects and sloping bottoms, and general circulation features are of greatest interest. This combination of factors, operating over a variety of space and time scales, necessitates a carefully planned approach that incorporates theoretical analysis, laboratory modeling, and field observations. The Strait of Gibraltar is the primary focus of the study. During the FY 1986 experiment, conventional and newly developed physical oceanographic instrumentation was deployed widely in the strait in a cooperative program involving scientists from the U.S., Spain, Morocco, Canada and France. Theories of hydraulic control, wind forcing, and turbulent transfer across the strait were tested. International analysis and interpretation of the data collected in the Gibraltar Experiment will continue for several years. However, the data collected and ideas about hydraulic control theory already have resulted in a new interpretation of the Strait's dynamics. The experiment also confirmed a 1973 prediction that western Mediterranean deep water contributes to the outflow into the Atlantic.

Geodetic Very Long Baseline Interferometry (VLBI)

NOAA plays a leading role in the application of VLBI to geodesy through the National Ocean Service. These measurements should provide answers to the global question concerning the "greenhouse" effect and any resulting rise in sea level. Three POLARIS Observatories located in Massachusetts, Florida, and Texas participate in the IRIS (International Radio Interferometric Surveying) earth orientation monitoring service. Serving as the operational center for IRIS activities, NOAA processes data to determine polar motion, UTI (universal time corrected for polar motion), baseline vectors, and other parameters of scientific interest. IRIS produces the most accurate temporal resolution of the orientation of the earth at the lowest operating cost of any service now in operation. It will play a central role in the new international service that beginning in 1988 replaces the Bureau International de l'Heure (BIH) and the International Polar Service. The program is sponsored by the International Association of Geodesy (IAG) and the Committee on Space Research (COSPAR) of ICSU.

The VLBI system employs multiple radio telescopes (antenna) to observe simultaneous signals from extragalactic radio sources called quasars. The delays from repeated observations can be used to determine the directions to the signals and vectors between the stations. VLBI can accurately determine the earth's crustal movements. This technique can be used for determining continental drift, crustal dynamics, changes in angular momentum of the earth, and glacial rebound. The measurements will resolve today's observed "relative" sea-level changes. Future global determination of absolute sea-level will provide the earliest detection of the "greenhouse" effect. This technology will enhance the ability of the U.S. to respond to an ever-changing environment and improve the efficiency and economic establishment of the geodetic systems. Accurate geodetic data is the foundation for all surveying, mapping, charting, and navigation of aircraft, ships, and submarines.

The FRG, Sweden, Italy, PRC, Japan, and South Africa have VLBI observatories. In the U.S., NASA and the U.S. Naval Observatory are participants in the program. Current U.S. expenditures are $1.5 million per year, and ten personnel are involved. It is estimated roughly that current foreign expenditures are $2.0 million per year, with about 30 personnel involved.

Marine Protected Areas

NOAA organized an International Marine Protected Area Management Seminar on June 1 to 12, 1986. The seminar, sponsored by the NOAA National Ocean Service, focused on the approaches available for the protection and sustainable use of various types of designated marine areas including marine national parks, fisheries and marine wildlife reserves, and protected underwater historic resources. The seminar was attended by 29 participants from 22 countries. The major tropical, warm temperate, and cold marine regions were represented including the Caribbean, North Atlantic, Mediterranean, South and Western Pacific, Indian Ocean, and others. A commitment was made to continue international information exchange through the establishment of an international network for individuals involved in the establishment, planning, and management of marine protected areas and the publication of an international newsletter in collaboration with the U.S. Man and Biosphere Program as a service to the network.

Exclusive Economic Zone (EEZ)

Activities continued during 1986 to identify exploitable resources in the Exclusive Economic Zone of the United States. The USGS vessel S.P. LEE continued to conduct detailed surveys for sulfide minerals along the Gorda Ridge off California and Oregon, preparatory to considering plans for mineral leasing. Bathymetric mapping activities also continued as the U.S. worked to refine mapping technologies and better identify the resource potential of its EEZ. In late FY 1986, the U.S. Navy submersible SEA CLIFF, working for the Interior Department's Minerals Management Service (MMS), recovered samples off the Gorda Ridge that indicate large deposits of copper, lead, zinc, gold, and silver. Future investigations are to include titanium-rich placer deposits off Georgia and other Atlantic states, sand and gravel deposits on the North Atlantic and Gulf Coast outer continental shelf (OCS), placer deposits on the Gulf Coast and West Coast OCS, and phosphorites off North Carolina. These studies will focus primarily on the commercial feasibility of leasing these areas.

MMS is responsible for developing policy and is developing a leasing program for the U.S. continental shelf. The intent is to encourage exploration, development, and production of non-energy minerals from the OCS. The leasing program will be implemented at an appropriate time after further research and analysis is completed. The continuance and ultimate success of such research activities could be vital as the U.S. seeks to lessen its dependence on foreign sources of certain strategic minerals. Under NOAA auspices, technical and scientist exchange programs and projects related to research techniques, data formatting, and industrial applications of multibeam technology have been proposed with Japan, France, and within global organizations such as the IOC and the International Hydrographic Organization. The continued development of mapping technologies could prove valuable to other countries that might seek U.S. assistance in mapping their EEZs.

The USGS initiated a major four-year marine program with Indonesia in 1986. The Indonesians declared an EEZ in 1978, and in 1984 they established a marine geologic institute to conduct studies of this region. They presently are constructing a 32-meter long geologic research ship that will begin a series of investigations when outfitted. Supported by an Asian Development Bank (ADB) loan, the Indonesians have contracted with the USGS for overall program planning, technical training, and advice on equipment purchases, installation, and operation.

Deep Seabed Mining

NOAA continued to implement the Deep Seabed Hard Mineral Resources Act in 1986 on several fronts. Regulations were proposed in July, 1986 for commercial recovery activities. Final regulations may be issued in 1987.

Activities conducted by four licensees under NOAA were monitored. This second year of their exploration licenses involved the continued evaluation of exploration data received from others as a result of private negotiations resolving site conflicts.

Research continued on environmental, economic, and mineral resource aspects of deep seabed mining. The results of these efforts are shared among seabed mining countries and will contribute to future decisions pertaining to such operations.

The NOAA Administrator designated Italy as a reciprocating state, bringing to five the number of foreign nations with domestic legislation similar to the U.S. law. The others are the FRG, France, Japan, and the U.K.

Circum-Pacific Map Project

USGS continues to coordinate compilation and preparation for publication a wide range of maps on the geology, energy potential, and mineral resources of the Pacific region and bordering countries under the auspices of the Circum-Pacific Council. Representatives of all countries bordering the Pacific participate in this project. Maps published, or updated and reprinted, during 1986 include: an energy resources map of the Circum-Pacific Region - NE Quadrant; a plate tectonic map of the Circum-Pacific Region - NE Quadrant; and a plate tectonic map of the Circum-Pacific Region - SW Quadrant.

Circum-Atlantic Map Project

In 1986, the International Union of Geological Sciences met and decided to draft a plan of action for a Circum-Atlantic Project. The success of the Circum-Pacific Project in compiling an integrated series of maps covering the ocean basin and adjacent continental areas was at least partly responsible for the interest in initiating a Circum-Atlantic Project. The Circum-Atlantic Project also will focus on the use of digital data bases, and on experimental compilations and interpretations of data for the selected areas of the project. The project will work closely with government agencies, oceanographic institutes, and energy and mineral companies that have data and expertise in the region. An interim steering committee has been established under USGS leadership to define the program and report to the parent organizations.

Marine Pollution

The U.S. is an active participant in research and international discussion on synthetic marine debris. This debris poses a threat to both endangered and non-endangered species of marine mammals, sea turtles, seabirds, and fish. These species become entangled in marine debris, ingest plastic materials mistaken for natural items of prey, and ingest material incidentally because it is associated with natural prey. This problem is particularly severe in the North Pacific Ocean where synthetic wastes may be a prime cause of the decline of the North Pacific fur seal. Persistent plastics in the ocean also are a potential threat to human safety as a result of fouling vessel propulsion systems. The disposal of plastic from ships incidental to normal operations is estimated at 639,000 plastic containers per day worldwide.

A Presidential determination on whether to ratify Annex V of the 1973/1978 Protocol Relating to the International Convention for the Prevention of Pollution from Ships (MARPOL Convention) is to be transmitted to the U.S. Senate for advice and consent. This Annex would provide an international authority for prohibiting the discard of fishing nets and other synthetic material from fishing vessels and other commercial ships. As a result of U.S. initiatives, the IMO Marine Environment Protection Committee was to consider a detailed U.S. paper on improving the effectiveness and enforceability of Annex V at the Committee's next session in February, 1987.

Research conducted by the NOAA National Marine Fisheries Service, and supported by the U.S. Marine Mammal Commission, provides a prime foundation for national and international management of the problem. These agencies hosted a November, 1984 International Workshop on the Fate and Impact of Marine Debris. Participants identified an urgent need for educating vessel operators and others about the marine debris problem, regulating the deliberate disposal of synthetic materials, and developing better quantitative data to assess the impact of debris on living marine resources. The NOAA North Pacific education program has made presentations to fishing representatives in the U.S., Japan, the Republic of Korea and Taiwan. The NOAA research and education program cost $900,000 in FY 1985 and $718,000 in 1986.

These findings were presented to the Ninth Meeting of the Consultative parties to the London Dumping Convention (LDC) in September, 1985 and to the International Maritime Organization's Marine Environmental Protection Committee in July, 1986. The Tenth Meeting of the LDC in October, 1986 adopted guidelines on disposal at sea of dredged material, continued studies of the impact of dumping of radioactive and other hazardous wastes and adopted terms of reference for an expert group dealing with incineration at sea. The mandate of the scientific group on dumping was broadened to include comparison of land and sea disposal options. It was decided to postpone the Eleventh Meeting to the autumn of 1988.

The 1984 Protocols to the 1969 International Convention on Civil Liability for Oil Pollution Damage and the 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage were reported on favorably by the Senate Foreign Relations Committee during the 99th Congress. Different versions of implementing legislation for the Protocols were passed by the Senate and House, but not reconciled.

Chapter 11 - TELECOMMUNICATIONS

U.S. Foreign Policy Objectives

U.S. foreign policy objectives in the field of international telecommunications and information policy remain as enunciated by Secretary of State Shultz in September, 1985:

1. Enhance the free flow of information and ideas among nations;
2. promote free competition for the new technologies in the global market place, while protecting our security;
3. support international cooperation to develop cost-effective and flexible international communications networks;
4. expand the economic and social benefits of communications and information throughout the world, especially to developing nations;
5. promote continued effectiveness of American industry internationally in the fields of communications and information; and
6. strengthen the national defense through communications and information policy.

The rapid and accelerating development of technology, particularly the explosion in the use of computers and the need to communicate data, has resulted in enhanced opportunities for U.S. industry. At the same time, this development also has increased the challenges of attaining U.S. policy objectives. Rapid developments have highlighted the differences in telecommunications operating climates between the U.S. and other countries.

The U.S. is virtually unique in having a telecommunications industry run by the private sector with a diminishing government regulatory function, as telecommunications are controlled by state monopolies to varying degrees in most of the rest of the world. Influenced by the benefits evident in the U.S. of deregulation and market-based decisions and pressured by their own businesses and institutions, the U.K., Japan, and some other industrialized countries are moving in the direction of greater liberalization. This movement, however, is tentative in most countries and faces resistance from entrenched interests that often are part of the telecommunications bureaucracy. Some countries are seeking to apply the fairly tight regulatory framework that has been typical of the telecommunications industry to new services involving computer-processed data being transmitted over new or existing telecommunications networks. The effect of this would prevent or control competition and limit access to markets for new services that multinational enterprises of the U.S. and others are seeking to provide. This is an important issue with major implications for U.S. trade, and an issue the U.S. will pursue in a number of forums, including the International Telecommunication Union (ITU) and its associated bodies.

International Telecommunication Union (ITU)

World Administrative Radio Conference for Mobile Services

A World Administrative Radio Conference (WARC) for Mobile Services (Mobile WARC) will be held at Geneva in September and October, 1987. The Conference will review and revise as necessary those provisions of the Radio Regulations for the mobile services dealing with terrestrial and satellite communications, radiodetermination, and radionavigation. The conference is important to U.S. aviation and maritime interests, and decisions made at the conference could provide important opportunities for U.S. commercial interests. For example, U.S. proposals will include allocation of radio spectrum to provide for the introduction of new satellite communication systems for mobile telecommunications users. The conference also will deal with the detailed provisions for mobile services that comprise more than two-thirds of the body of the International Radio Regulations.

U.S. interagency coordination continued throughout 1986. In July, a draft of U.S. technical proposals was distributed to representatives of 41 countries in a special meeting at Geneva. International consultations continued in 1986, but were not as extensive as had been hoped, since other countries were not as far along in their preparations as the U.S. The U.S. plans an intensified pace of consultations in the period leading up to the conference. Such consultations will be important to persuade other countries of the benefits of the new services that new technology has made possible, especially in countries where market forces have less scope.

World Administrative Radio Conference On High Frequency Broadcasting (WARC-HFBC)

The second session of the World Administrative Radio Conference for planning the short-wave broadcasting bands took place at the headquarters of the ITU at Geneva, February 2 to March 7, 1987. The first session of the conference held in early 1984 had adopted technical parameters and planning principles for testing a new computerized method of assigning frequencies to the shortwave broadcasts of all ITU members. After reviewing the results of intersessional tests conducted by the International Frequency Registration Board (IFRB), the second session was to attempt to achieve a consensus on an improved assignment procedure and to modify the international radio regulations as necessary.

The initial results of tests of the planning method were distributed worldwide by the IFRB. These results clearly indicated that adoption of the proposed planning method would not satisfy the requirements of major broadcasters and would even require suspension of a significant portion of existing broadcasts. The U.S. and a growing number of other nations have adopted the position that any planning method that requires the suspension of essential broadcasting requirements is totally unacceptable. The U.S. is not prepared to abandon its historic commitment to international short-wave broadcasting, and will not accept any method resulting in a substantial reduction of U.S. broadcasting requirements. Given the realities of broadcasting practice and the consensus nature of ITU conferences, the proposed planning method cannot be imposed against the will of the major broadcasting nations. However, as the integrity of the ITU is important to U.S. interests, the U.S. is prepared, in conjunction with other major broadcasters, to work toward a compromise package of partial and/or gradual remedies around which a consensus can be built.

Jamming by the Soviet Union and other Bloc countries is another important issue in the context of the WARC-HFBC. Jamming has taken place since 1948, and the U.S. has persistently objected to this violation of obligations by the USSR under the Radio Regulations of the ITU and more recently, the Helsinki accords.

The U.S. requested in 1984 and 1985 that the ITU International Frequency Registration Board (IFRB) undertake a technical study of jamming of U.S short-wave broadcasts originating in the Federal Republic of Germany (FRG). The IFRB unanimously adopted a detailed report in September, 1986 that identified and documented 37 frequencies of the Voice of America (VOA), Radio Liberty, and Radio Free Europe that were being jammed by the USSR, Poland, and Czechoslovakia. The IFRB further notified these three governments of its findings, and requested that they take action to comply with their international obligations.

The subject of jamming is a regular agenda item in various international forums, but this is the first time an official technical body within the U.N. system has reviewed data assembled by many countries, documented jamming, issued a report, and asked the offending parties to desist.

High Definition Television

Advanced television systems have been the subject of considerable interest within the private sector and U.S. Government. Dramatic new standards are being studied for studio/production systems, delivery systems, and receiver display systems in order to take full advantage of modern technology. The most advanced of these new systems is high definition television (HDTV), making possible significant improvement in picture quality with respect to detail, resolution, richness of color, picture stability, and projection size.

Developmental work on HDTV technology has been underway in the U.S. and other countries for more than a decade. The Advanced Television Systems Committee (ATSC), a voluntary industry organization, was established in 1983 to consider all forms of advanced television techniques. The ATSC developed and adopted a recommendation in early 1985 for a worldwide HDTV standard for the studio and for international program exchange. There are potential technical and economic benefits inherent in the adoption of a single worldwide electronic medium, such as facilitating the international exchange of video programs. The appropriate body for such an agreement is the International Radio Consultative Committee (CCIR) of the ITU. The Department of State formally submitted the ATSC draft recommendations to the final meetings of the CCIR Study Groups in the fall of 1985. The CCIR Study Groups report was approved for submission to the Plenary Assembly in May, 1986. At the Plenary Assembly, a coalition of European Economic Community (EEC) members primarily concerned with protecting the interests of European manufacturers of broadcasting and home electronics equipment was instrumental in postponing for two years a decision on the worldwide HDTV studio standard.

Center for Telecommunications Development

The U.S. participated in the activities of the Advisory Board of the Center for Telecommunications Development, created by the ITU Administrative Council in July, 1985. The Advisory Board adopted a mandate for the Center at its June, 1986, meeting that reflects recommendations submitted by the Independent Commission for Worldwide Telecommunications Development (*i.e.*, the Maitland Commission) and guidelines established by the ITU Administrative Council. The Center has been organized according to the mandate as a new multilateral entity bringing together governments and industry for the purpose of strengthening "the scope and extent of advisory services and technical support to developing countries with a view to remedying, through innovative effort, the imbalance in the distribution of telecommunications in the world". The Center's activities will be limited to the pre-investment, pre-commercial stage. At the June meeting, the Advisory Board also elected Dietrich Westendorp of the FRG as its first Executive Director.

The U.S. Government recognizes that the development of telecommunications infrastructure is a key factor in promoting economic development, and has invited the private sector to become a partner in providing communications development assistance. A first step has been a matching contribution for the new Center from the U.S. Government and the private sector scheduled to be paid in late 1986.

World Administrative Telegraph and Telephone Conference (WATTC)

A WATTC is to convene in 1988 to consider proposals for a revised international framework for telecommunications services reflecting the emergence of new telecommunications technology and services. Preparations for the Conference have taken place throughout 1986 and will continue in 1987 within the framework of the Consultative Committee for International Telegraph and Telephone (CCITT) of the ITU. WATTC is an opportunity for the U.S. to pursue its objective of deregulating international telecommunications markets. In recent preparatory meetings, however, most of the U.S. partners in the North Atlantic telecommunications area have proposed revisions that attempt to define as many distinct services as possible in the body of the new regulations, and try to impose a regulatory umbrella over all providers of "international telecommunications services". The U.S. Government opposes such revisions, as they would inhibit competition and development of new international information and value-added services using advances in computer and telecommunications technology.

The U.S. objectives at the conference are to ensure that:

1. The new telecommunications regulations are drafted in a way that promotes the greatest possible flexibility in defining what constitutes a service;

2. The specific delineation of what constitutes a service should be left to CCITT recommendations rather than being made part of the Telegraph and Telephone Regulations, so that new services based upon the new and evolving technology can most easily be brought to the market place; and

3. Only entities that provide public international telecommunications services, excluding data processing activities, fall within the scope of the revised regulations.

Bilateral Telecommunications Activities

U.S.-Mexico Agreement on AM Broadcasting

The U.S. and Mexico signed a new AM broadcasting agreement in August, 1986 that provides increased broadcasting opportunities for both countries. The agreement ends the unduly restrictive protection that former "clear channel" stations received, and will permit the licensing of a substantial number of new stations. Two other elements of the agreement are of particular importance to the U.S.:

1. Approximately 300 stations that could only broadcast during the day will now be able to broadcast around the clock; and

2. Over 2000 daytime-only stations will be permitted two additional hours of broadcasting during the early evening.

U.S. Coordinator's Visit to China

U.S. Coordinator and Director of the Bureau of Communications and Information Policy of the Department of State, Ambassador Diana Lady Dougan, headed a five-person delegation to the People's Republic of China (PRC) in July and August, 1986. The visit was hosted by the PRC Ministry of Posts and Telecommunications. Talks at Beijing covered a broad range of multilateral issues related to international telecommunications. The two countries' size and complex telecommunications needs result in similar views on a number of telecommunications issues, the most notable difference being over U.S. support for separate systems to compete in certain services with Intelsat. The Chinese were pleased to receive a policy-level delegation. They agreed that the dialogue should continue and that the two countries should exchange views extensively before and during international conferences. Ambassador Dougan invited the Chinese to send a policy-level delegation to the U.S. in the spring of 1988 for the next round of broad-based discussions. The Beijing talks were followed by visits to three important provincial cities to discuss the impact of current Chinese decentralization policies on telecommunications, and to assess the opportunities for the increased flow of information to local telecommunications entities.

International Satellite Communications

PanAmSat and Other Systems Separate from Intelsat

President Reagan determined in November, 1984 that international communications satellite systems separate from the International Communications Satellite Organization (Intelsat) are "required in the national interest". The Federal Communications Commission (FCC) in July, 1985 authorized separate systems with the restrictions that the systems could not be interconnected with public-switched networks (i.e., telephone, telex or telegram systems); and one or more foreign authorities have to authorize the use of each system and enter into joint consultations with Intelsat under the Intelsat agreement. The Pan American Satellite Corporation (PanAmSat) is the first such separate system provider to reach a service agreement with a foreign country (i.e., Peru). The U.S. and Peru initiated consultations in May, 1986 with Intelsat on the provision of new services between the two countries. The proposed services are intended to be primarily video and, in compliance with the FCC ruling, not interconnected with public-switched networks. Technical and economic consultations took place in the summer and fall of 1986. The U.S. Government-supported PanAmSat objective was to have endorsement by December, 1986 of the new services from the Board of Governors at its regular meeting followed by approval of an extraordinary Assembly of Parties.

A number of Intelsat member countries, particularly developing countries, are uncertain or opposed to separate systems for fear that the competition will damage Intelsat, a system they see as providing essential international telecommunications services at reasonable cost. The U.S. position is that it was not intended for Intelsat to have a monopoly on international satellite services. In fact, separate systems have been in operation for a number of years in Europe, the Middle East and Asia. The U.S. is unique in the restrictions that it has voluntarily imposed in order to protect the economic viability of Intelsat, limiting the new services to a small segment of the marketplace.

It is the U.S. view that Intelsat itself is best positioned to compete in the marketplace because of its established reputation, expertise and existing global relationships. Intelsat has reacted to proposed competition over the past several years by introducing new services and lowering the price of existing services in some areas. The U.S. has explained through contacts with other governments that competition would stimulate the market and make new services available to all at lower prices, over-riding the concern that separate systems pose a threat to Intelsat. This competition would benefit the developing countries most concerned about Intelsat's viability, and those that have not been adequately or imaginatively served by it. The U.S. will continue efforts to convince developing countries, while remaining sensitive to their concerns, that they ultimately will be served best by an international climate in telecommunications that encourages new technology and services.

Organization for Economic Cooperation and Development (OECD)

The OECD Committee on Information, Computers and Communications Policy (ICCP) has intensified its efforts to support the work of the OECD Trade Committee on trade in services by testing the applicability of a conceptual framework for services traded in communications and information markets. This has come about through a decision taken by ministers of the General Agreement on Tariffs and Trade (GATT) at Punta del Este in early 1986 to include services on the negotiating agenda for the new trade round. The delegates to the ICCP readily agreed to examine computer services and computerized information services, for the most part unregulated in all OECD countries, as part of the testing exercise. Inclusion of telecommunications services that are highly regulated in all of Europe except the U.K. was opposed initially by many countries with a monopoly on telecommunications structures. However, a compromise appears to have been reached under which the ICCP will include issues involving access to and use of telecommunications transport services as part of its testing exercise.

The ICCP in 1987 also will begin separate exercises involving major studies on the economic effects of liberalization in telecommunications services and on emerging structures for the provision of value added services.

National Telecommunications and Information Administration (NTIA)

NTIA finalized in 1986 a five-year agreement with the PRC on telecommunications cooperation. NTIA also conducted telecommunications infrastructure development assessments for two Caribbean countries, and provided spectrum management training to 26 U.S. Telecommunications Training Institute students from developing nations. The improvement and expansion of telecommunications infrastructure will facilitate economic growth in the developing countries. NTIA efforts will contribute to the increased visibility and acceptance of U.S. telecommunications equipment and services in those countries.

China Protocol

The telecommunications protocol signed on May 16, 1986 is a five-year agreement between the U.S. Department of Commerce (*i.e.*, NTIA) and the Ministry of Posts and Telecommunications of the PRC. The purpose of the Protocol is to promote scientific and technological cooperation between China and the U.S. in the field of telecommunications. This five-year program is aimed at fostering closer U.S.-China cooperation in the telecommunications sector, and was created to facilitate telecommunications infrastructure improvement in China and to provide U.S. telecommunications firms expanded commercial opportunities in a major overseas market.

The first activities under the Protocol are scheduled for FY 1987, and consist of exchange visits by teams of experts between the U.S. and China. The exchanges will focus on the development of a long-range telecommunications plan for China. An annex to the Protocol will be developed in FY 1987 on specific objectives to be accomplished in FY 1988. The total estimated Federal cost of the Protocol over the five-year period is about $1.3 million. Approximately $29,000 was spent in FY 1986. In FY 1987, planned expenditures are $260,000.

Telecommunications Infrastructure Development

The Caribbean Telecommunications Infrastructure Development Project is founded on the belief that telecommunications stimulate economic development, and that the information transmitted by means of an adequate telecommunications infrastructure facilitates trade, investment, and national stability. This project is a joint effort of NTIA and the International Trade Administration (ITA) within the Department of Commerce.

In 1986 NTIA and ITA, supported by a team of participants from the U.S. telecommunications industry, conducted a technical assessment of the existing and planned telecommunications systems for Jamaica and Guatemala. The team visited host government officials responsible for telecommunications in each country to discuss national telecommunications policies, and met with officials from the domestic and international telecommunications authorities. The team produced a report based on the discussions that delineates projects that would advance the development plans of the telecommunications authorities. These reports were coordinated with and formally presented to the minister responsible for telecommunications in each country. The reports also were made available to the U.S. telecommunications industry. The effort has resulted in arrangements for the specialized training of seven Guatemalan telecommunications officials through the U.S. Telecommunications Training Institute. It is expected that in the long-term this efforts will help in developing future markets for U.S. equipment and services in the Third World. Combined NTIA, ITA, and U.S. Trade and Development Program 1986 funding for this project was approximately $130,000.

The Caribbean project was founded on a model created by NTIA in the Western Pacific where three island nations are in the process of establishing a 15-year financial and political arrangement with the U.S. known as the Compact of Free Association. As the result of an NTIA-led mission to these emerging nations (i.e., the Republic of the Marshall Islands, the Federated States of Micronesia, and the Republic of Palau) the Micronesians succeeded in securing eligibility for U.S. concessionary financing from the Rural Electrification Administration (REA). REA financing will increase the likelihood that the administrations of these new countries will purchase U.S. equipment and services. Until the NTIA-led field assessment, the Micronesians had planned to purchase Japanese telecommunications equipment with extremely favorable financing arrangements.

U.S. Telecommunications Training Institute

The U.S. Telecommunications Training Institute (USTTI) was established in 1982 by Ambassador Michael Gardner for providing hands-on and managerial training in telecommunications for the developing countries of the world. The USTTI is a non-profit, educational organization and a joint venture between the U.S. Government and the private sector. NTIA in conjunction with the U.S. Information Agency (USIA), the Federal Communications Commission (FCC), and the Department of State has played a key role in the creation and continuation of the USTTI. The goal of the USTTI is to share this country's telecommunications advances on a global basis by providing a comprehensive selection of free telecommunications training courses each year for qualified individuals from developing countries. The training courses range from training in spectrum management to sophisticated satellite technology instruction. In 1986, 28 separate telecommunications courses were offered by USTTI. These courses were taught by private sector companies such as AT&T, MCI, and Western Union, and by U.S. Government agencies (i.e., NTIA, FCC, and VOA). The USTTI has graduated over 970 participants from 91 developing nations since its first year of offering training in 1983.

NTIA has been instrumental in planning and developing the USTTI curriculum selection list since the inception of the Institute in 1982. NTIA has cosponsored a course in "Radio Spectrum Management and Computer-Aided Techniques" since 1983. In 1986, a total of 26 international telecommunications engineers and managers from developing countries participated in this course. The participants came from all areas of the developing world including the Bahamas, Brazil, Brunei, Cyprus, Egypt, El Salvador, Ghana, Guatemala, Haiti, Hong Kong, Iraq, Israel, Jamaica, Malawi, Nepal, Pakistan, Philippines, Sri Lanka, Tanzania, and Thailand. Approximately $70,000 were spent in 1986 to support this effort. In four courses since 1983, NTIA has taught 91 participants, almost 10 percent of all USTTI graduates.

Telecommunications training in methods and technology helps Third World governments use the radio frequency spectrum and operate their telecommunications more efficiently. This sharing of telecommunications technology makes the Third World a participant in preserving this limited and valuable resource throughout the entire world. U.S. representatives to international telecommunications conferences and meetings have begun to encounter colleagues who exhibit a greater openness and understanding of the U.S. and its positions on various international telecommunications issues. Contacts established through the USTTI also facilitate the arrangement of cooperative programs with foreign administrations on telecommunications trade, development, and radio spectrum management issues.

Chapter 12 - TRANSPORTATION

International transport priorities have this past year reflected efforts to develop and adopt policies to improve safety and security, and to promote and facilitate the export of U.S. transportation technology. Accomplishments and ongoing efforts in these areas by the Department of Transportation (DOT) have been enhanced considerably by relationships established with foreign counterparts through bilateral science and technology (S&T) cooperation programs and participation in activities of multilateral organizations.

As safe and efficient national and international transport systems impact the economic welfare, quality of life, and political stability of all countries, DOT works closely with transportation officials of other countries to develop and improve these transport systems worldwide. DOT has a coordinating mechanism which assists management in maximizing use of limited travel funds by arranging multipurpose and multicountry visits for the development, expansion, and review of cooperation programs. In addition, greater reliance is placed on affecting information exchanges by correspondence.

DOT has formal and informal bilateral arrangements for the exchange of information, or collaborative research with 23 countries and participates in the work of 24 international organizations. DOT also is involved in providing cost-reimbursable technical and training assistance to approximately 65 countries. Major activities and the known technical benefits derived from them during FY 1986 are summarized in this chapter. They were selected as representing recent and substantial progress toward fulfillment of one or more of the following objectives:

to access and share transport technology and experience in order to reduce research costs and avoid wasteful duplication of parallel national efforts;

to find solutions to common technical and operational problems, particularly in safety and security areas;

to participate in special multilateral research projects, and coordinate national positions in international organizations;

to support U.S. foreign policy; and

to promote sales of U.S. transportation equipment and technology.

Bilateral Programs

Canada

Deputy Secretary Burnley and a DOT delegation were hosted by Canadian Deputy Minister of Transport Withers at a two-day meeting held at Vancouver in connection with the International Technical Exposition (EXPO 86). The delegation held discussions on policy issues of mutual interest, including Canadian policy initiatives for transportation reform; U.S. airport funding; U.S. and Canadian subsidy programs for intercity rail passenger service; cost recovery user fees in the aviation, marine, and highway areas; and other aviation, maritime, motor carrier, and railroad policy positions and plans. During the meeting, a Project Agreement under the 1970 Memorandum of Understanding (MOU) between DOT and Transport Canada was signed, establishing the basis for continuing mutually beneficial cooperative work on freight car safety technology.

The cooperative program relating to arctic marine transport systems continued during FY 1986 despite reduced budgets in both countries. The Maritime Administration (MARAD) is the lead U.S. agency in this program, involving participation by the U.S. Coast Guard (USCG), the State of Alaska, the Interagency Ship Structure Committee, the U.S. Navy, and a number of private energy and transportation companies. Cooperative efforts were extended to include U.S. Government icebreaker tests in the Great Lakes to determine tow-rope resistance in level ice. These data, never before available, provide a scientific basis for the design of improved icebreaking vessels.

The Urban Mass Transportation Administration (UMTA) and Transport Canada cosponsored the Fourth International Conference on Mobility and Transport for Elderly and Disabled Persons, held July 21-23, 1986, in Vancouver as one of the events of EXPO 86. The contribution of UMTA to this Conference was $15,000. The Conference provided cross-cultural exchanges on the state of the art of transportation programs designed to enhance the mobility of the elderly, handicapped, and other transportation-disadvantaged persons.

Other cooperative activities during EXPO 86 included the Federal Highway Administration (FHWA) providing an exhibit manned by the State of Washington and FHWA field personnel that contained many devices to illustrate technology transfer activities related to highway construction and safety. Cost to the U.S. for the exhibit was $13,000. The MARAD and USCG participated in a highly successful Polar Transportation Conference from May 4 to 8. USCG vessels and personnel participated in the Expo 86 Search and Rescue (SAR) week, demonstrating SAR equipment and techniques.

Under the U.S./Canada Joint Marine Pollution Contingency Plan, three USCG officers attended a two-week Canadian Coast Guard Marine Emergency Management Course at the Training Institute in Cornwall, Ontario. Two other USCG officers made presentations during the course which analyzed a variety of major marine pollution scenarios and joint response plans. USCG personnel also participated in the Ninth Arctic Oil Spill Program Technical Seminar sponsored by Environment Canada, and USCG aircraft participated in Canadian air shows in Ontario and Montreal.

Technical as well as many tangible and intangible benefits to the U.S. and Canada are gained from sharing results of transportation research, jointly participating in project tasks to develop new design data, and holding discussions on national policy developments. Participation in various U.S.-Canadian conferences positively contributes to cooperation as important working contacts are established among specialists with a common concern and area of interest. As neighbors and allies, both countries are committed to developing viable transport systems for the safe and efficient movement of goods and people across a common border.

People's Republic of China

DOT continued expanding cooperative ties with its Chinese counterparts during 1986 as envisioned by Secretary Dole during her 1985 visit to the People's Republic of China (PRC). Annex I to the Transportation Protocol regarding cooperation in highway technology with the Ministry of Communications was signed in Washington on October 10, 1986.

As a separate effort in the highway area, the Federal Highway Administration (FHWA) provided support to the World Bank in conjunction with a program to implement modern transportation planning technology in the PRC. Two experts were detailed to the Bank on two separate missions to the PRC with the objective of designing and implementing a study of transportation investment priorities. The PRC provided a team of experts from the various transport modes and governmental jurisdictions to participate in the study. The use of U.S. technology and standards in the transportation field has an inherent advantage in that it capitalizes on U.S. leadership in transportation investment analysis, and ultimately will benefit U.S. consulting firms active in this area. Costs for this effort are estimated to be $12,400 to the World Bank and $10,780 to FHWA.

A protocol involving cooperation in areas of locomotive and track design and maintenance, communications systems, and railroad transport management and operations has been agreed to between DOT and the PRC Ministry of Railways. The protocol is scheduled to be signed at Washington during the fall of 1986.

The Federal Aviation Administration (FAA) and the General Administration of Civil Aviation of China (CAAC) concluded an umbrella agreement to cover cost-reimburable technical6assistance. The first annex to the agreement provides for the coproduction inspection by FAA of McDonnell-Douglas MD-80 aircraft being assembled in Shanghai. Proposed annexes concerning training of Chinese students in airworthiness and air traffic control, and FAA assistance in the development of a Chinese air navigation system plan will significantly broaden cooperation in this area. The FAA also conducted inspections at Beijing and Shanghai airports for security compliance, and at the aircraft repair base facility in Beijing for standards compliance. Deficiencies and concerns identified during these inspections have been remedied.

The U.S. Coast Guard has completed negotiations with the PRC Bureau of Harbor Superintendency on a Search and Rescue (SAR) Agreement which will be signed in Washington the first part of 1987. Other USCG cooperation included the following activities:

1. During November 1985, a USCG C-130 aircraft again participated in the annual Search and Rescue Exercise in Hong Kong which included PRC observers. A USCG training team conducted a SAR training course for PRC and Hong Kong participants, prior to the exercises.

2. In May 1986, a USCG C-130 aircraft participated in the first National Aerospace Exhibition in Beijing, sponsored by the U.S. Department of Commerce. The C-130 was displayed to senior Chinese military and government officials to demonstrate its search and rescue capabilities.

3. At the request of the International Maritime Organization and the Chinese Government, a USCG officer was sent to China for two weeks to assist in the development of an offshore pollution surveillance system.

The PRC has placed high priority on the rapid development of improved transportation as demonstrated by the planned major investments over the next 10 years. DOT involvement in the Chinese transport modernization effort has potential for gaining technical benefits for the U.S. in certain transport-related basic science areas, and its interface with Chinese government entities will create opportunities for U.S. private industry.

Federal Republic of Germany

Based on the 1973 Memorandum of Understanding for cooperation at the Department-Ministerial level, Secretary Dole and Minister of Transport Dollinger signed a Project Agreement concerning highway engineering and operations research cooperation during the Minister's visit to the United States in October, 1985. The agreement, which updates and expands a previous agreement, includes plans for cooperation on alternate routing systems in freeway corridors, urban network signal control systems, integrated urban area traffic management systems, motorist information systems, improved accident analysis and safety evaluations, coatings for structural steel, fatigue and corrosion of cables in bridges, and experimental verification of pavement design methodology.

FAA conducted helicopter blade noise tests in Germany, and cooperative exchanges on aircraft crashworthiness were conducted.

Japan

The Federal Railroad Administration (FRA), Amtrak, and the Japanese National Railways (JNR) concluded an agreement during the summer of 1986 to continue JNR technical assistance to the U.S. Northeast Corridor Improvement Project (NECIP). FRA-Amtrak-JNR cooperation in the NECIP under the renewed agreement during the past seven years has proved beneficial. JNR will continue to maintain a team of specialists in the U.S., and meetings of these and other specialists in both countries are planned. Primary areas of mutual interest are:

1. completion of NECIP work in centralized electrification and traffic control, electric traction, rehabilitation and conversion, signal installation, and equipment maintenance;

2. methods of operating and improving rail passenger service; and

3. management and regulation of rail freight and passenger service. Each side has agreed to bear the cost of work carried out by its own personnel.

Technical exchanges with the Japanese at the annual meetings of the Transportation Research Panel have resulted in significant economic benefit to both countries, primarily in the rail, transport construction, marine, aviation, and environment areas. U.S. and Japanese managers and specialists agree that the exchanges, and the reviews of policy issues and transport planning concepts at the national level are particularly useful; they encourage continuation of the program.

The Netherlands

The annual meeting for review of cooperative activities, outlined in the MOU between DOT and the Netherlands Ministry of Transport and Public Works (MOT), was held in Washington during April, 1986, under the cochairmanship of Deputy Assistant Secretary for Policy and International Affairs Philip Haseltine and the Head of MOT International Affairs Directorate Jeroen F. Schoots. In-depth discussions and presentations on transport planning, transport safety, and policy issues were held during plenary sessions and working group meetings of specialists. Special U.S. presentations included an overview of transportation aspects of recent trends in world coal trade, and on the economic impact of freight transport deregulation. DOT-MOT discussions included: (a) methods for determining research priorities and research program direction; (b) procedures for long-range highway program planning; (c) high speed rail travel demand; (d) various urban transport research and operational issues; (e) highway safety programs in the U.S. and Europe; and (f) traffic safety programs (e.g., drunk driving prevention and safety belt usage promotion and legislation).

A project agreement between FAA and the Department of Civil Aviation (DCA) was signed in January, 1986. The agreement established the scope of FAA-DCA cooperation in implementing the ICAO-adopted Microwave Landing System (MLS) to avoid duplication of effort, and to minimize costs. Cooperative efforts have been directed primarily toward accomplishing the extensive work involved in the timely worldwide transition from instrument landing systems to MLS, in accordance with international plans.

DOT and MOT managers and specialists confirm that on-going technical exchanges, and regular meetings to discuss policy and operational issues, provide significant technical benefit to each country. Discussions regarding potential changes in Dutch and European policy development especially are valuable to the U.S. side. Further, bilateral exchanges of technical information, and discussions of common problems and issues, often lead to coordinated efforts to stimulate cooperative work or desirable actions by multilateral organizations.

Spain

The U.S.-Spain Joint Committee for Scientific and Technological Cooperation approved funding for two transportation safety-related proposals. In March, 1986, based on favorable recommendations by DOT specialists, a project entitled "Nonlinear Analysis and Ultimate Strength of Thin Shell Concrete Structures was funded for $64,500, and will be carried out by the Polytechnic University of Barcelona and the University of California at Berkeley. The other project, funded for $56,200, is entitled "Three Dimensional Response to Bridge Deck Systems to Traveling Seismic Waves", and will be conducted by the Polytechnic University of Madrid and George Washington University, Washington, DC.

United Kingdom

The 1981 MOU between DOT and the U.K. Department of Transport (DpT), renewed during Secretary Dole's May 1984 visit to London and extended last July, will remain in force until November, 1987. The MOU provides for cooperative exchanges in highway design, highway and traffic safety, transit policies, traffic engineering, and urban transport systems and investments. In response to a U.K. initiative, DpT was advised that DOT was interested in expanding the bilateral cooperation program to the maritime area.

The Honorable David Mitchell, Member of Parliament and Deputy Secretary of State for Transport, led a delegation of London transportation officials to the Urban Mass Transportation Administration's Private Transit in the Public Sector Conference in Orlando, Florida, on November 18 and 19, 1985. The delegation reported on the experience of the U.K. in privatizing public transport. As a follow-up to this Conference, the UMTA Associate Administrator for Budget and Policy participated in the DpT competitive contracting process, created as a result of the London Regional Transport Act of 1984. The knowledge gained through studying the experiences of DpT in this program has been beneficial to UMTA in developing and implementing a program to involve the private sector in providing and financing mass transportation in the U.S.

International Organizations

Participation in international organizations and special multilateral programs has many positive aspects. For example, harmonization of standards ensures that those designed for safety, the protection of health, and the environment are not just well-disguised non-tariff trade barriers. Consequently, such highly technical activity has a positive effect on international trade by eliminating potential areas of controversy. Technical discussions also provide a forum for the protection of the interests of U.S. industry through the introduction of cost-benefit considerations in instances when a proposed regulation, recommendation, or standard does not provide enough additional safety to justify the added cost. Further, problems and ideas can be presented and discussed in multilateral forums which might not be properly voiced or understood elsewhere. The free flow of ideas in such groups often leads to the recognition of special foreign expertise which can be the basis for mutually rewarding bilateral cooperation. The results of bilateral cooperation can, in turn, stimulate recognition of the need for more broad-based multilateral discussions or action.

European Conference of Ministers of Transport (ECMT)

DOT continued its association with the ECMT through attendance of Assistant Secretary for Policy and International Affairs Matthew V. Scocozza at the 1986 Spring Session of the Council of Ministers. The subjects considered included a report on the relationship between transportation and computer technology and telecommunications. The report emphasized the need for close international cooperation to develop standards and procedures for the exchange of information in the field of transportation; it described how advanced technology, such as computerized driving simulators and electronic traffic control, can be used to improve safety and efficiency.

The Council of Ministers agreed to discuss a priority U.S. aviation topic concerning increased cooperation for improved airport security. The resulting Council resolution included a pledge "to strengthen cooperation at all levels, and particularly to exchange information relating to security and technological developments in aircraft and airport security". This was a landmark step in getting ministerial-level support for an important U.S. initiative.

The International Road Federation

A continuing contract between the Federal Highway Administration (FHWA) and the International Road Federation permits publication of periodic inventories of ongoing and recently completed research studies from all over the world in an annual "World Survey of Current Research and Development on Roads and Road Transport". Cost to FHWA for FY 1986 was $170,000.

International Union of Railways (UIC)

The Federal Railroad Administration (FRA) in DOT continued its work with the UIC. In addition to responding to a number of inquiries on technical questions referred from member countries, the FRA forwarded extensive information to the UIC on railway noise and wheel safety research, on FRA report on Rail-Highway Crossing Safety; adn illustrative material on "Operation Lifesaver", a program to educate the public on safety awareness in rail operations. Further, FRA assisted private U.S. industry regarding questions on UIC railway standards and codes relating to potential U.S. foreign business opportunities. DOT is able to maintain an awareness of new developments in the international railway community through membership in the UIC/ORE. The exchange of technical information has contributed to preventing duplication of effort in areas where U.S. and foreign railway technology are comparable. Cost to FRA for annual membership in UIC is $40,000.

Organization for Economic Cooperation and Development

The Office of the Secretary of Transportation, Federal Highway Administration (FHWA) and National Highway Traffic Safety Administration (NHTSA) continued active and rewarding participation during FY 1986 in the Road Transport Research Program (RTRP) and the International Road Research Documentation (IRRD) program of the Organization for Economic Cooperation and Development (OECD). The scientific and technical activities of the 1986-88 RTRP triennial program cover a wide range of topics within the general categories of road infrastructure, road traffic control and driver communication systems, road and traffic safety programs, urban and interurban road transport, and transfer of technology to developing countries.

Two RTRP study groups, with FHWA participation, completed studies and published reports entitled "Traffic Safety of Elderly Road Users" and "Full-Scale Pavement Tests". Results of these studies have contributed to improvements in highway safety design, and to the coordination and comparability of standards for international pavement test programs. Reports of studies on cost-beneficial designs for low-volume roads, maintenance and management of pavements, and toll financing and private sector involvement in road development have been completed and are awaiting publication. FHWA representatives are participating in new task groups concerned with pavement testing, concrete bridge durability, movement of hazardous materials, motorist communication systems, and pavement monitoring techniques.

A major accomplishment during FY 1986 was a NHTSA initiative to evaluate the effectiveness of safety belt usage programs among participating countries, many of which have had mandatory use laws in effect for some time. NHTSA staff members collected and analyzed information on safety belt use rates and accident statistics in light of related legislation in various countries. Last fall more than eighty experts from fourteen countries participated in a traffic safety workshop held in Washington. The workshop was divided into six sessions: Safety Belt Usage Laws in Various Countries, Safety Belt Usage Rates, Safety Belt Use Rate and User Characteristics, Casualty Reductions - Results from Safety Belt Use Laws, Rear Seat Belt Use, and Effectiveness of Child Restraint Laws. Each session consisted of one or more presentations by a member of the workshop planning group, followed by prepared comments from selected workshop participants. The workshop proceedings will be published and widely distributed as part of on-going effort by DOT to significantly reduce traffic accidents and fatalities.

Pan American Railway Congress Association (PARCA)

The Federal Railroad Administration continued its involvement with PARCA by carrying out post-meeting responsibilities related to sponsoring the XVI Congress at Washington in 1984. Activities included publication of the Proceedings of the XVI Congress, review of research papers; and meetings with representatives of PARCA, the Organization of American States, and government officials of other agencies.

U.N. International Civil Aviation Organization (ICAO)

The FAA continued its active participation in ICAO by attending annual assembly meetings, committees, and technical panels. Major activities by the U.S. during 1986 included:

1. A voice communications link between air traffic control centers in the USSR, Japan, and Alaska (Anchorage) was implemented in July through trilateral discussions initiated through ICAO. The link was established to prevent a repeat of the KAL 007 tragedy.

2. In response to an appeal by Secretary Dole, the ICAO completed, in record time, a rewriting and tightening of international aviation security standards contained in Annex 17 to the Convention on International Civil Aviation.

3. A U.S. delegation was instrumental in establishing, through ICAO, a single Flight Information Region for the Pacific Ocean area. This action allows a single communications system in Honolulu to link all air traffic control communications for the Pacific area to the air traffic control center in Oakland, California.

Cooperation and coordination between countries in aviation system development and operations are crucial in maintaining and increasing safety of air transport on a global basis. Participation of FAA in ICAO has significantly benefited the U.S. and other countries, and will continue to benefit them, as aviation technology advances, and projected demands for increased air capacity become realities.

U.N. International Maritime Organization (IMO)

The U.S. Coast Guard (USCG) continued its active participation in IMO, representing the U.S. at meetings of the Assembly, the Council, the Maritime Safety Committee (MSC), the Marine Environment Protection Committee (MEPC), the Legal Committee, Technical Cooperation Committee and associated subcommittees. Major U.S. activities at IMO during FY 1986 included:

1. The adoption by IMO of technical security measures to prevent unlawful acts against passengers and crews on board ships. This was a major U.S. initiative following the hijacking of the Italian liner, ACHILLE LAURO, and the murder of a U.S. citizen on board. The security measures were drafted by the USCG, introduced, finalized, and adopted by IMO in less than one year after the hijacking.

2. Equipment requirements for a Future Global Maritime Distress and Safety System were finalized by IMO. This system will dramatically improve distress communications capabilities and will result in increased effectiveness of worldwide search and rescue operations.

3. A major amendment to the 1973-78 Marine Pollution Convention was developed which will significantly limit the amount of hazardous and toxic chemicals being discharged into oceans.

Special Multilateral Programs

Central American Corporation for Air Navigation Services (COCESNA)

The FAA completed a systems modernization requirements study in January, 1986 on behalf of COCESNA. This was a joint corporation set up by El Salvador, Guatemala, Costa Rica, Honduras, and Nicaragua to provide air navigation services in these Central American countries. In July 1986, the COCESNA Board of Directors formally approved the FAA-recommended system modernization program which will cost approximately $4 million.

Computer-Aided Operations Research Facility (CAORF)

The Maritime Administration (MARAD) within DOT continued its involvement in cost-reimbursable work at CAORF during 1986. Major work included:

1. Panama Canal Widening Study. This multi-year study involves testing and research into many facets of widening the existing Panama Canal. The Panama Canal Commission furnished $145,000 during FY 1985 and FY 1986 to complete this study.

2. International Marine Simulator Forum (IMSF). The CAORF Managing Director, who serves as Chairman of the IMSF, attended a meeting of the group held in Toledo, Ohio to review progress in developing a standard method for exchanging mathematical ship modeling data.

3. Cadet Training Program. CAORF completed a cooperative program with the College of Maritime Studies in Warsach, England. The purpose of the program was the joint study of various simulator exercises and methodologies to develop optimal programs for training prospective licensed personnel in bridge watchstanding procedures. The program was very beneficial to both schools. The U.S. Merchant Marine Academy (USMMA) has finished modification of training manuals and has implemented new, improved approaches for training cadets.

Strategic Highway Research Program

Twenty-eight representatives from 16 countries, along with representatives from FHWA, American Association of State Highway and Transportation Officials, NRC, the World Bank, the International Road Federation, and OECD, gathered for a three-day workshop at Washington to discuss international participation in the forthcoming Strategic Highway Research Program (SHRP). The major area of concentration in the workshop was pavement performance. The SHRP will be a separately funded program administered by NRC.

Science and Technology for Development

Africa

Under the direction of Secretary Dole, DOT is continuing its active role in implementing the "lessons learned" from problems encountered in food aid logistics during the height of the 1984-1985 famine in Africa. A DOT transport planner was detailed full-time in June, 1986 at the request of AID to assist in the development of transport information systems and logistical programs designed to expedite delivery and reduce the cost of food in future emergencies.

Caribbean Basin Initiative (CBI)

DOT continued to chair the CBI Transportation Working Group (TWG). FY 1986 activities included creation of task groups to prepare a draft manual on ocean freight rates for traders and investors, and to assess maritime and aviation training needs of the region and identify private and public organizations which should take the lead in addressing these needs. DOT also has contacted private sector organizations to begin identifying causes of unnecessary costs and inadequate service that could be improved by joint efforts with minimal financial investment. In this latter effort, priority would be placed on port safety, security, and maintenance.

Technical Assistance

DOT is engaged extensively in providing technical assistance primarily in the aviation, marine, highway, and transport system planning areas to individual countries and geographic regions. Most of this work is carried out through cost-reimbursable agreements. Major activities by mode, including known costs, are summarized below.

Aviation

Colombia. The Colombian Civil Aviation Administrative Department signed an umbrella memorandum of agreement in February, 1986 providing for FAA technical assistance on a bilateral basis. The Colombians also have requested the FAA to assist them in their procurement of radar and processing equipment from U.S. industrial sources. Total estimated cost of the procurements will exceed $6 million.

Bahamas. The FAA and the Bahamas cooperated in the procurement and installation of an airport surveillance radar at Nassau International Airport. The system was commissioned for operation in May, 1986. In addition to providing air traffic control at Nassau, the installation includes data transmission to the Miami Air Route Traffic Control Center, filling a gap in coverage between U.S. radar installations in the Caribbean.

Egypt. FAA performed an in-depth aviation security assessment of Cairo International Airport. Based on the recommendations of the FAA report, AID will develop equipment specifications and contract for $5.2 million worth of improvements at Cairo. AID has also agreed to fund a proposal by FAA for a study of Egypt's aviation technical assistance needs. The study will cover airman and aircraft certification, radar automation, airports, air navigation facilities, flight safety, and management.

Jordan. FAA has a five-member team in Amman assisting the Jordanian Civil Aviation Authority in carrying out its flight safety missions. The team provided assistance and counterpart personnel training in aircraft and airman certification, as well as inspection and regulation of civil aviation operations.

Kuwait. FAA provided advisory services to the Ministry of Public Works' International Airport Improvement Program during FY 1986.

Morocco. Westinghouse Electric Corporation submitted a report on the system specification development phase of a program designed to modernize Morocco's air traffic control system. FAA will provide technical advice and oversight assistance on behalf of the directorate of Civil Aviation.

Marine

A USCG officer funded by AID is assigned to the IMO as a Regional Consultant for the Caribbean. This officer provides technical assistance to nations and territories of the Wider Caribbean Region in the areas of maritime safety and disaster preparedness. Emphasis is on port safety, search and rescue, oil spill contingency plans, and cruise ship disaster contingency plans.

A USCG officer is assigned to the Panama Canal Commission as a Marine Safety Advisor to Panama. USCG officers also are assigned as U.S. Security Assistance Offices to advise local maritime forces in Barbados, Costa Rica, Jamaica, Liberia, Panama, and the Philippines. During FY 1986, USCG Technical Assistance Field Teams were deployed to Antigua, Grenada, and St. Christopher-Nevis to assist in the development of Coast Guard organizations.

Four USCG officers were assigned to U.S. Navy ships during their United American States (UNITAS) exercises in Latin America and during a West African training cruise. The officers conducted symposia and provided advice on maritime law reinforcement, search and rescue, port security, and marine environment protection. These symposia were open to local Coast Guard officials during port calls in various countries. A USCG cutter was assigned to the Caribbean phase of UNITAS. The cutter conducted joint exercises with Caribbean Coast Guard forces, and provided technical assistance in the operation and maintenance of equipment. A USCG officer was assigned to the Departments of State through the Defense-sponsored African Coastal Security program to provide technical assistance to West African countries in developing their fisheries surveillance and enforcement programs.

Costs for USCG technical assistance activities during FY 1986 are estimated at $1.6 million.

Highway and Transport Planning

Chad. An FHWA engineer completed a nine-month assignment in Chad, during which he assisted in initiating a road rehabilitation program to restore the transportation system. The project is being funded by AID and is designed to assist the government in establishing a functional highway department, and to reconstruct important roadway links throughout the country. Costs to AID were $14,900.

Costa Rica. The FHWA is assisting the Costa Rica Ministry of Public Works and Transportation in supervising the construction of 36 highway projects, funded by the Inter-American Development Bank. FY 1986 costs were $114,500.

Grenada. FHWA is involved in establishing a maintenance management system for rural farm and collector roads and is integrating these roads into Grenada's highway network. A highway engineer, hired under a State-Federal Interagency Agreement, has been assigned to Grenada for a nine-month period. The project began on September 15, and the FY 1986 costs provided by the World Bank were approximately $10,000.

Jamaica. An economist from the Office of the Secretary of Transportation recently completed an assignment to develop a program for improving 450 miles of farm-to-market roads in Jamaica. The $7,000 in funds for the program were provided by AID.

Kuwait. A staff of 12 FHWA highway engineers is assisting the Kuwait Ministry of Public Works in the long-term development and construction of a modern system of freeways and major arterial roads. FY 1986 costs were approximately $3.25 million.

Panama. A three-man team of FHWA bridge experts visited Panama to inspect the deck of the Bridge of the Americas for soundness, and to develop recommendations for resurfacing the roadway. Plans, specifications, and cost estimates are being prepared and will be delivered to the Government of Panama as the final product of this technical assistance project. FY 1986 costs were $12,000.

Saudi Arabia. DOT continued technical and administrative oversight of the TRANSPORT program for the establishment and management of a modern surface transportation system in Saudi Arabia. During FY 1986, the program was carried out by four support personnel at DOT headquarters, 12 full-time specialists in country, and several short-term specialists. Cost of the program for FY 1986 is estimated at $6.5 million. In the aviation area, agreement was reached in principle on a program for FAA assistance in developing Saudi standards and infrastructure. Also it was agreed to continue the ongoing pilot certification program.

Training of Foreign Nationals

The USCG and FAA continued various cost-reimbursable programs during FY 1986 for training foreign nationals at DOT and other facilities in the U.S. When necessary, the U.S. responded to requests for in-country evaluations of training needs.

Aviation training was provided to more than 380 foreign students, for which tuition costs are estimated at $595,000. Classes including subjects such as air traffic control, flight standards, and airport management were conducted exclusively for foreign students.

The Coast Guard provided $45,000 in tuition and fees for five of the ten foreign cadets who graduated from the USCG Academy in 1986. The Coast Guard also provided search and rescue training to 24 personnel from Indonesia, Malaysia, and Thailand to assist these countries in rescuing Vietnamese refugees at sea. Training was provided for about 100 foreign military personnel at the request of the U.S. Navy under the U.S. Security Assistance Program. During 1986, USCG and U.S. Customs Service training teams were sent to Caribbean countries to instruct local Coast Guard and law enforcement personnel in maritime drug interdiction techniques and vessel boarding procedures.

International Visitors

DOT Headquarters and field staff planned for and received approximately 2,000 foreign visitors during FY 1986. Topics of discussions ranged from transport technology and research priorities in all modal areas to operational and policy issues (e.g., the impact of deregulation, privatization studies, and safety regulations). Requests for visits were received from counterpart transport organizations, U.S. and foreign embassies, USIA foreign visitor programs, other government agencies, representatives of private industry, and individual contacts of DOT staff in international groups.

Budget and Resources

DOT does not have a special appropriation for carrying out international activities. A total budget figure for supporting these activities would defy estimation because of the varied missions of DOT entities and their interwoven advisory, operational, and regulatory responsibilities. Costs are borne by the participating entities, funded through arrangements with other government agencies or international organizations, and through cost-reimbursable technical assistance agreements with foreign governments. DOT believes that the policy of having the department operating administrations support non-reimbursable international cooperation activities from program funds assures that only activities producing technical benefits will be pursued.

Small, full-time, international staffs are maintained in the Office of the Secretary, the U.S. Coast Guard, the Federal Highway Administration, the National Highway Traffic Safety Administration, the Maritime Administration, and a somewhat larger contingent in the Federal Aviation Administration. These team members provide policy guidance, and coordinate and monitor cooperative activities. Some staff members perform these functions in addition to their regular operational activities. For example, the Coast Guard and FAA find it impossible to identify discrete costs associated with international technical exchange programs since these are conducted in conjunction with, and in support of, their own domestic responsibilities. AID funds the salaries and all travel and overhead expenses for two full-time professionals and one support staff person who conduct technical assistance studies on particular problems in developing countries. These professionals are assisted on special projects from time to time by other DOT staff members.

Senior-level personnel at DOT and specialists in the Secretary's office and modal administrations conduct the important substantive discussions with foreign counterparts on cooperation programs and policy issues. Man-hours (in terms of dollars) expended by these staff members on international exchange programs have been roughly estimated because they are not readily identifiable from related international work in areas of policy, trade, and primary national program management responsibilities. DOT believes that establishing and implementing an administrative system to capture the total personnel time expended on international S&T work (or any other comparable effort that is an integral part of its overall mission) would be difficult, time-consuming, and cost-ineffective.

Considering the above realities, DOT estimates that in carrying out its international exchange activities during FY 1985 it spent approximately $18 million for salaries and travel expenses of Headquarters and field personnel, and approximately $600,000 for participation in work of various international organizations.

Chapter 13 - DEFENSE

International Cooperation for Technological Excellence

The U.S. seeks to enhance the security of the Free World through promoting international defense S&T cooperation among allies and other friendly nations. Two vital components of this policy are the mutual exchange of military technology with allies of the U.S., and denial of militarily useful technology to potential adversaries.

Both the U.S. and its allies are making major advances in basic sciences and technologies. It is our ongoing objective to integrate these advances into U.S. military capabilities, and to persuade U.S. allies and other friendly nations to increase their own fielded military capabilities. Through sustained cooperation in technology and development, the U.S. improves the effectiveness of its own defenses, increases mutual compatibility of military forces, and strengthens alliances. The U.S. continues to advise countries to establish or strengthen technology security programs in order to deter the uncontrolled flow of Free World technology to the Soviet bloc, other hostile countries and terrorist organizations.

NATO Armaments Cooperation and Defense Trade

The important goal of the NATO science program is to achieve economies of scale by coordinating research, development, production, and logistic support. The U.S. and its allies can accomplish this by equitably sharing and protecting mutually developed technology to avoid unnecessary expenditures and duplication of effort. The U.S. routinely consults with its European counterparts to establish operational and design requirements for future weapons systems. Cooperative joint research development, production and acquisition programs are explored thoroughly. The areas of greatest interest include establishing common operation and design requirements, maintaining mission effectiveness, bilaterally sharing technology with near equal benefits, using economies of scale, avoiding duplicative costs, and standardizing NATO forces and equipment to enhance interoperability. Section 1103 of Public Law 99-145 (Nunn Amendment to the FY 1986 Defense Authorization Act) provides funding for the U.S. Government to engage the NATO allies in a wide variety of cooperative research and development programs. This congressional initiative has sparked renewed efforts within NATO to improve conventional defense capabilities and to reduce or eliminate duplicating efforts in research and development. Eight multilateral and several bilateral programs are in various stages of negotiation, with more being planned for 1987.

This cooperation and trade is carried out in a framework of coordinated measures to maintain technology security. The Department of Defense (DOD) has made technology security an integral element of agreements with NATO and other allies on cooperative defense programs in technology, such as the Strategic Defense Initiative, and an important part of other collaborative efforts.

The members of the Coordinating Committee on Export Controls (COCOM)--NATO nations (excluding Iceland) and Japan--continue to strengthen that organization, and to negotiate with non-COCOM countries for the protection of advanced Western technology from unauthorized military or dual-use exploitation by adversaries.

NATO Defense Research Group (DRG)

DRG is the highest NATO forum for the discussion of its scientific and technical research needs. The Deputy Under Secretary of Defense for REsearch and Advanced Technology represents the U.S. The DRG conducts research where cooperative efforts might lead to increasing military capabilities, or where technological advances are needed for current programs.

The DRG acts through panels and working groups to assign, approve, and review cooperative efforts. Panel activities are focused within well defined areas of interest, and address specific needs agreed upon by the DRG. Currently, panels are addressing the role of emerging technologies in NATO in physics and electronics, optical and infrared sensors, human and biomedical sciences, electronic warfare, air defense and concealment. One panel is conducting long-term studies of maritime operations in the year 2005, robotics on the battlefield, chemical defense, and command post surveillance.

Although participation in specific panels by the allies differs depending upon interest and resources, the U.S. participates in all DRG panels and most panel subgroups. In all, DRG has seven panels, two special subgroups, and 42 research study groups.

The U.S. improves its own military science and technology through active interaction and cooperation with the NATO scientific community fostered by the DRG. This has resulted in significant advances in such areas as optical/IR systems, camouflage techniques in the NATO environment, and potential emerging technologies in NATO.

Advisory Group for Aerospace Research and Development (AGARD)

AGARD was founded in 1952 to stimulate advances in the aerospace sciences for the common defense of NATO. It annually sponsors 20 symposia and specialist meetings, eight lecture series, and approximately 100 consultations and exchanges between members. Approximately 100 senior U.S. scientists and engineers participate in these activities. AGARD also is one of the world's largest publishers of technical information, publishing approximately 90 documents annually, and is one of the most referenced technical sources in U.S. publications. The unclassified publications of AGARD are distributed to over 350 government, industrial and academic organizations, and are entered into the National Technical Information Service (NTIS) system. Classified AGARD publications are placed into the Defense Technical Information Center system.

AGARD encourages a true two-way flow of technical information between the U.S. and its NATO allies. AGARD ensures that DOD scientists are informed of European activities and programs, facilitates joint research efforts between the U.S. and its allies, and allows U.S. scientists access to advances made by the allies. The Air Force (USAF) serves as the executive agent for the U.S. The USAF Assistant Secretary for Research, Development, and Logistics serves as the senior U.S. representative to the AGARD National Delegates Board.

Supreme Headquarters Allied Powers Europe (SHAPE) Technical Center

The SHAPE Technical Center (STC) was founded in 1955 to provide scientific and technical advice and assistance to the mother agency (i.e., SHAPE) of Allied Command Europe (ACE).

STC analyzes ACE force capabilities, and examines International Command, Control and Communications (C3) for ACE. The STC staff of 350 consists of 110 scientists, 110 technicians and computer specialists, and 130 administrative personnel. The Center's program of work involves ACE studies in force capabilities, structure and sustainability, defensive and offensive operations, and C3.

The U.S. provides 21 scientist and engineers for the Center's staff. Drawing upon resources of all the NATO allies, the Center annually works on approximately 30 projects that improve the NATO C3 capabilities. Each year STC publishes approximately 20 to 30 reports and enters them into the Defense Technical Information Center system.

The Center provides the opportunity for U.S. and European scientists and engineers to work jointly on NATO problems. U.S. personnel return to positions designed to utilize the knowledge and experience gained during their three-to-five year tour at STC. The USAF serves as the executive agent for the United States. USAF Assistant Deputy Under Secretary for C3 serves as the senior U.S. delegate to the Center's Committee of National Representatives.

The Technical Cooperation Program (TTCP)

TTCP is one of the most effective international S&T cooperative programs of DOD. Participants include Australia, New Zealand, Canada, and the United Kingdom. The TTCP provides a means for participating countries to become acquainted with each others' defense research and development activities. This, in turn, allows for mutual coordination of national programs. The program concentrates primarily on military technology and technologies relevant to defense. Some areas covered include chemical defense, undersea warfare, infrared and electro-optical technology, aeronautics, conventional munitions, and electronic warfare. TTCP-sponsored information exchanges, collaborations, seminars, and symposia have fostered international cooperation in defense technology.

Foreign Weapons Evaluation Program

The Foreign Weapons Evaluation Program evaluates foreign systems, equipment, and technologies to avoid duplication in development, to enhance compatability and standardization, and to promote international technology exchange. Candidate programs are proposed by the Military Service, for review by the Office of the Secretary of Defense (OSD) staff. OSD considers the validity of the Service requirement, maturity of the proposed system, potential for procurement, and other factors. The programs selected are then funded by independent appropriations by the Director of Defense Test and Evaluation.

Six programs were selected by the Services within the past year, bringing the program's five year total to 20, with a procurement value exceeding $1 billion. Approximately 30 programs are currently in the test phase, with an additional 30 programs under review for funding.

The NATO Armaments Cooperation Steering Group, chaired by the Deputy Secretary of Defense, reviewed the Foreign Weapons Evaluation Program in late 1984. This review, in conjunction with Congressional interest, resulted in an increase in program funding. The success of the program can be measured by the comparative return on its investment. The current return is over $20 for each dollar invested, compared to a return of $3.20 for other U.S. and United Kingdom R&D investments.

Australian, British, Canadian, American (ABCA) Standardization Program

The ABCA Standardization Program continues to provide the mechanism for standardizing military operations and technology developments among the participating nations. In FY 1986, 14 Quadripartite Standardization Agreements (QSTAGs) were ratified by the U.S. Senior Army representatives met on May 12 through 16, 1986 to discuss opportunities for standardization in the mid- and low-level conflict spectra. They directed their respective armies to identify interoperability gaps, and to develop milestones for achieving interoperability of an ABCA force by the year 2000 for moderate and low-level conflict in remote areas. The ABCA armies have begun validation plans for specific QSTAGs, using exercises as a vehicle for non-material agreements to determine the operational value to the user, whether or not it meets user requirements, and if it is up to date. This validation also verifies that an agreement is properly implemented. QSTAGs are being selected and validation teams are being established for the scheduled ABCA exercises, command post exercises in 1987 and field test exercises in 1989.

Non-Nato Armaments Cooperation and Defense Trade

Northeast Asia (Korea, China)

The U.S. continued to support the Republic of Korea during FY 1986 with technological consultations and cooperative armaments development in order to strengthen its defense capabilities in tanks, missiles, and C3 equipment. Efforts also are underway to strengthen technology security in order to permit continuation and expansion of cooperative programs.

The U.S. has assisted the modernization of the defensive capability of the People's Republic of China within specific mission areas that do not threaten the security of the U.S., its allies, or other friendly nations in the Pacific Basin. This year, Congress approved two Foreign Military Sales programs, one covering artillery ammunition and another on upgrading avionics on China's F-8(II) interceptor. Contractor bids on these programs are expected. The U.S. also is progressing in discussions for a naval program and other areas of technical cooperation.

Two-Way Technology with Japan

Recognizing Japan's considerable technology base and its potential benefit to U.S. defense systems, the U.S. is expanding efforts to develop more technology and systems cooperation with Japan. An emphasis is placed on encouraging a flow of Japanese military technology to the U.S. First, the U.S. must work with its industry and the Services to identify specific technologies that offer potential benefit, then arrange for the transfer. The first two military technology transfers to the U.S. were approved September 5, 1986 by the Japanese government. One transfer involved a U.S. Army request from the Japan Defense Agency and a private Japanese company, and the other concerned an agreement between private firms in Japan and the U.S.

Increased cooperation with Japan strengthens the U.S. industrial base through the infusion and stimulation of technology in the areas where Japan has a lead. It increases the efficiency of U.S. research and development resources by preventing duplication of Japanese programs, and focuses U.S. attention on developing and introducing better systems within the U.S. Finally, it improves interoperability with Japanese fielded systems, thereby improving the security force structure in the northern Pacific. In this regard, DOD consults regularly with the private sector through the Defense Policy Advisory Committee on Trade (DPACT).

Technology and systems cooperation is coordinated through a DOD-Japan Defense Agency forum that oversees a number of working level groups. One approach used to develop cooperation is to convene a meeting of technical experts with the objective of assessing threats, then identifying the systems and technologies available or needed to meet them. This year, the U.S. and Japan established the first of such groups to work on air defense and C3 missions.

Each of the Services has designated a Flag Officer to organize and manage a program of technological cooperation with Japan, and to act as principal contact within the Service. The potential for joint R&D is being explored.

The Japanese government formally announced on September 9, 1986 its acceptance of the U.S. invitation to participate in the Strategic Defense Initiative (SDI). All transfers of U.S. and Japanese SDI-related military technology will be governed by the procedures agreed to last year. Also noteworthy is the U.S. and Japan cooperation on safeguards to reduce high technology transfers to the Soviet bloc.

Australia, South Asia, and Southeast Asia

The U.S. concluded a Memorandum of Arrangements during 1986 with Australia to begin the first collaborative R&D program involving a shipboard defense system that will improve the capabilities of both navies. The U.S. also is considering extending to Australia the cooperative research, development, production and armament fielding provisions recently developed for NATO. During this year, the U.S. exchanged technical teams with India to explore areas for cooperation in military systems. DOD currently is defining programs for these initiatives. DOD continues to work with the Association of Southeast Asian Nations (ASEAN) to find areas of mutual benefit in the face of the regional communist threat.

Industrial Cooperation with Pakistan

The Defense Industrial Cooperation Agreement has become a significant positive factor in U.S. and Pakistan relations. This agreement is designed to improve the industrial base and benefit the commercial sector by advancing production techniques for items purchased by the average consumer. The agreement also is an important part of the U.S. total security assistance package to Pakistan.

The most recent addition in bilateral industrial cooperation was the Agreement on Cooperative Import-Export Strategic Technology, signed on July 17, 1986 to assure Pakistan's continuing access to U.S. technology. In this pact, Pakistan agreed to provide importation and exportation protection for those U.S. commodities and technical data controlled for national security reasons.

R&D Efforts with Israel and Other Middle East Nations

The U.S. is continuing armaments cooperation with friendly Middle East nations, especially Israel and Egypt. Cooperation with Israel has provided valuable battlefield information to the U.S. Services. The Memorandum of Agreement between the U.S. and Israel has led to significant exchanges of technical information, cooperative R&D programs on new systems, exchanges of scientists and engineers, and U.S. procurement of proven Israeli weapon systems. Several co-production programs with Egypt operate under the U.S. Defense Production Assistance Agreement. This agreement has been amended to provide for data exchange at minimal cost.

Latin America

Bilateral cooperation with Latin American nations has increased with the refinement of regional requirements and military capabilities. The U.S. continues to hold exploratory talks seeking opportunities to develop self-sufficiency in selected defense items in Central America, and to encourage defense related production in the Caribbean Basin. Although scientific and engineering exchanges with Brazil continue, the broader technical cooperation outlined in the 1984 MOU on Industrial Military Cooperation has been slowed by the failure to reach agreement on general security procedures. This problem is being addressed on a case-by-case approach concentrating on basic programs that can be expanded as appropriate.

Challenges and Opportunities

The U.S. must look to international cooperation in the research, development, and production of armaments as a means of strengthening the security and economic base of the Free World. Through partnership with its allies the U.S. can build better systems. With greater standardization and common procurement costs, and strengthen the interoperable character of military forces.

Recognizing that most of the international cooperation will be carried in the private sector, the U.S. needs to establish a government level environment that encourages technology cooperation, and resists protectionist or trade restrictionist attitudes, while protecting military technology from unauthorized use by U.S. adversaries. Particular attention must be paid to the newly industrializing countries (NICs) of the Pacific Rim, with their increasing technical capabilities. The U.S. must continue to emphasize the vital importance of export control regimens by the high level encouragement of allies and friendly countries to increase their enforcement efforts and strengthen the penalties for violations.

DOD currently has reciprocal MOUs with its NATO allies that lessen or remove barriers to defense trade. DOD expects to combine these bilateral arrangements into a comprehensive U.S.-NATO agreement. This would be a positive step toward the integration of the European defense market. Western security and technology cooperation in armaments within NATO would be significantly easier should Europe be able to organize its defense research, development and production on a scale more comparable to that of the U.S. The Independent European Program Group in NATO, and the Western European Union are making great progress toward this objective. In the East, the U.S. is continuing efforts to develop a two-way flow of technology with Japan. As cooperative initiatives mature in NATO, DOD plans to expand these missions to other nations.

Chapter 14 - SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

Organization of AID for Science and Technology

The overall organization of the Agency for International Development (AID) was restructured in 1981. The objective of the restructuring was to strengthen the scientific and technical component with respect to its policy and programs. This new organization has been described in previous editions of this report, and this structure remains valid.

Collaboration with the U.S. Scientific Community

AID continues to collaborate closely with the U.S. scientific community. An important mechanism for this collaboration is the Memorandum of Understanding (MOU), a long-term agreement between AID and one or more universities for cooperation in areas of high priority within the major sectors of agriculture and health. In return for a commitment by AID to provide resources, the university guarantees to make available a specified number of faculty in certain fields for long-term assignments. To date, agricultural MOUs have been signed with Colorado State, University of Florida, Purdue, Utah State University, and Washington State. Ten new joint MOUs have been signed during 1986. A joint MOU involves a program in which the university signatory is a partnership of an 1862 land-grant institution, or a university with substantial AID programs, and a historically black college or university.

The ten joint MOUs in agriculture were signed between Oregon State and Tuskegee University, Michigan State and North Carolina A&T, Auburn University and the University of Arkansas at Pine Bluff, University of Minnesota and Lincoln University of Missouri, University of Wisconsin and Virginia State University, University of Illinois and University of Maryland-Eastern Shore, North Carolina State University and Florida A&M University, Ohio State University and Fort Valley State University, Texas A&M University and Prairie View A&M University, New Mexico State University and Tennessee State University, Kansas State University and Alabama A&M University, and Louisiana State University and Southern University. Four joint MOUs in health were signed between Tulane University and Morehouse School of Medicine, North Carolina University and Howard University, Columbia University and Meharry Medical College, Johns Hopkins University and Charles R. Drew Postgraduate Medical School. The total amount for these single and joint programs is approximately $4.1 million.

AID continues its efforts to strengthen S&T capability in field missions abroad (USAIDs). Under the Joint Career Corps (JCC) ten faculty members, each from a different U.S. university, held positions of responsibility in ten separate missions during 1986. Two of these, assigned to Cairo and Bangkok, are concerned entirely with S&T. These individuals play a catalytic role as science advisors to the missions in the development of overall S&T strategies and programs for AID in the host countries. Currently AID is recruiting a faculty person for a JCC assignment in New Delhi. In addition to these three assignments, many other JCC positions now provide

AID continues a program of "reverse JCC" as part of an effort to keep the technical expertise of its full-time direct-hire staff up to date. This mechanism allows AID staff members to spend approximately one year of teaching and research at a U.S. land grant university in a field of high priority for development. This experience stimulates greater interest at the host university in development issues, as well as providing the AID staff member with new insights for future assignments. To date, eight "reverse JCCs" have been placed.

Significant Program Initiatives and Achievements in FY 1986

Agriculture

The AID agricultural research program emphasizes the needs of poorer segments in developing countries. Activities in research and technology transfer include improved genetic materials for food crops and livestock, methods of reducing pre-harvest and post-harvest losses, management techniques to maximize sustainable yields with affordable inputs, and economic analysis of policy factors affecting agricultural productivity.

A major portion of the S&T portfolio deals with agriculture research. Some of the interesting developments of the past year that may help less developed countries (LDCs) become self-reliant are summarized in this section.

Animal Vaccines to Help LDCs Increase Animal Protein Production. AID funded the Improved Animal Vaccines through Biotechnology Project in FY 1986 with the goal of developing new and improved vaccines for animal diseases that severely limit production and income generation in developing countries. Using new methods of biotechnology, the project focuses on diseases that impact on developing countries. This activity addresses the animal disease rinderpest which is an acute, febrile, and highly contagious disease of ruminants, particularly cattle and buffalo. The disease occurs in both Africa and Asia, and is manifested by a rapid course and greater than 90 percent mortality. A vaccine was developed for rinderpest over 30 years ago, but it was not easily adapted to the conditions in Africa and eradication programs have been unsuccessful. This project is using genetic engineering to develop an improved vaccine against rinderpest that is better suited to the conditions in the developing world.

A team of experts was brought together to carry out this work at the University of California at Davis. Scientists from USDA, NIH, California Biotechnology, Inc., and the Government of Kenya are collaborating in the effort. AID provided $870,000 in FY 1986 to fund this planned three year effort. An expansion of this project is proposed for FY 1987 to apply new technologies to develop vaccines for two other important diseases, anaplasmosis and babesiosis.

Drought-Tolerant and High Quality/High Yielding Pearl Millet Varieties. Staple food in the driest areas of India and sub-Saharan Africa is provided by 26 million hectares of pearl millet. Grain quality studies have shown that pearl millet grain is a highly nutritional grain for both humans and animals. It has potential as a low-cost alternative dryland feed grain crop in the LDCs and the U.S.

Research under the Sorghum Millet Collaborative Research Support Program has generated early-maturing seed-parent lines that have been used to produce high yielding hybrids. These hybrids were tested in India and Senegal during the past year. In Senegal, new varieties produced larger yields earlier than local varieties. One variety gave 900 kilograms per hectare (820 pounds per acre) grain on only 215 milimeters (8.5 inches) of rain. AID provided $3.4 million in 1986 to fund this global sorghum/millet project.

Biologic Nitrogen Fixation by Beans. Nitrogen fertilizers are expensive, and in many LDCs unavailable for crop production. Recent efforts by researchers of the Bean/Cowpea Collaborative Research Support Program at the University of Wisconsin, University of Minnesota, and Michigan State University have developed dry-bean lines which fix 80 pounds of nitrogen per acre in conjunction with the International Center for Tropical Agriculture (CIAT) in Colombia, the Instituto Nacional de Investigaciones Agricolas (INIA) in Mexico, Escuela Agricola Panamericana (EAP) in Honduras, and the Centro Nacional de Pesquesa de Arroz e Feyao (CNPAF) in Brazil. Dry bean yields are increased without increasing production costs. In addition to the economic benefits and increased yields, this accomplishment reduces groundwater pollution that may occur with heavy use of commercial fertilizers. Benefits from this research will accrue to dry-bean producers and consumers in the U.S., as well as in the LDCs. AID provided $3.4 million in FY 1986 to this multi-disciplinary global research program that has resulted in other major research breakthroughs in the past five years.

Tissue Culture Techniques Incorporate Resistance to Disease and Insects into Peanuts. The peanut is cultivated on more than 600,000 hectares in the U.S. and 20 million hectares in 82 developing countries. Approximately one-third of the potential production is destroyed annually by diseases and insects. Crop improvement has been slow due to a limited number of resistant lines of the domesticated peanut. The plant breeding component of the Peanut Collaborative Research Support Program is incorporating resistance to peanut pests from wild-type species into domesticated cultivatable varieties. Highly resistant genotypes have been found in wild species of the peanut; however, crosses between wild species and domesticated species have resulted in sterile offspring. Tissue culture methods have been developed by the Peanut Collaborative Research cytologists at North Carolina State University to overcome the incompatibilities. Interspecific hybrids have been developed between the domesticated peanut and several wild peanut species. Fertility has been restored and collections made with high levels of disease and insect resistance. Selections for leaf spot resistances are especially important and they significantly will reduce chemical treatments in the U.S. and improve profit margins. In LDCs, higher yields will be realized in increased income generated at the marketplace both for seed and for cattle feed because foliage from resistant varieties do not defoliate. Most importantly, the cooperative linkages set up under this program strengthen the scientific institutions in the developing countries, and benefit the U.S. directly through the interchange of genetic material that enriches the base available to U.S. researchers. In FY 1986, $2.4 million was allocated to this activity.

Milkfish (Chanos Chanos) Research. Sponsored research on the reproductive biology of the milkfish at the Oceanic Institute of Hawaii for the past two years has demonstrated that it is possible to artificially control the maturation of milkfish. Both male and female reproduction is stimulated by implanting LHRH (luteinizing hormone-releasing hormone) female hormone in the dorsal musculature of the adult fish. The hormone is released over an approximate 30 day period, causing development of eggs and sperm, and leading to spawning after about 90 days. A normally short annual spawning period of two to three months can be lengthened to over a full year with repeated spawnings. This method of controlling fish reproduction is breakthrough technology that can be applied to other species. The work of the Oceanic Institute has been extended three more years, and major efforts will be placed on technology transfer to developing countries and the involvement of additional species. The milkfish was chosen for the initial research because of its importance as a low priced food fish in Southeast Asia. Transfer of the technology to other species in other geographic areas eventually may prove to be of even greater benefit. This new 1986 initiative is funded annually at $1.2 million for three years.

Policy Research Improves Economic Environment for Development. The strategy for stimulating agricultural development recognizes that a healthy economic environment is as important as the physical environment. Free access to markets for input and output, satisfactory and stable prices for products, and the opportunity to spend increased disposable income on reasonably priced goods and services are as important to farmers in choosing whether to increase productivity and output as are adequate soils, water, and climate.

AID implements its strategy of fostering healthy economic environments for agricultural development through stimulating an on-going dialogue with host governments on options for reform of restrictive agricultural policies. AID lays the groundwork for policy dialogue by sponsoring research into economic issues concerning the sector. AID also assists 12 host governments building the capacity to examine the impact of their economic policies on performance of the agricultural sector, and on the distribution of benefits derived from scientific and technological advances.

Substantive achievements in policy research have been notable over the last year in Africa, where many governments are disappointed with their past efforts at stimulating technological advance in agriculture. These attempts typically were costly, subsidizing programs to stimulate production or artificial maintenance of high prices for producers. Policy research has helped some African governments reject urban, cheap food programs that artificially suppressed prices, and hurt agricultural producers' efforts for technological advance.

An analysis of rice policies in Liberia, for example, revealed that the government's efforts to foster self-sufficiency by buying rice at artificially high prices was costing nearly $3.00 in lost national income for every $1.00 invested. This was due to waste and excessive costs from losses in storage, an overstaffed public procurement, handling and marketing bureaucracy, and lost net export revenues because investments in added rice production yielded less than the country's traditionally more profitable export tree crops of rubber and cocoa. Research on fertilizer subsidies in Niger revealed that farmers were able to profit from use of competitively priced fertilizer if they could get it. Additionally, public resources tied up in the subsidies would do more for farmers, and the national economy, if invested in research and extension services for getting better fertilizer-use technologies into practice.

Agriculture policy research also has helped expand the development impact of AID by rallying other donors to support causes. The fertilizer subsidy policy research in Niger, for example, was used by the World Bank to develop part of its structural adjustment lending program in that country. In a new African initiative this year, AID is leveraging a small amount of resources with those of FAO to co-sponsor a series of regional workshops on market intervention and pricing policies. The strategy behind AID cooperation with FAO is getting African policy researchers to share experiences on how their analyses can contribute more effectively to policy change, spreading and replicating AID country program efforts throughout the region. At the same time, AID seeks to encourage FAO to shift away from concentrating on assistance to public planning and management of the agricultural sector, and instead support analytical studies to identify policy measures that enhance the capacity of market forces in charting the direction of, and provide the stimulus for release of, untapped private initiative in the sector.

Impact of the Bumpers Amendment. As a result of the recently enacted Bumpers Amendment, AID will be examining its activities, particularly in the area of agriculture research. The review is designed to determine whether an activity designed to increase production of a particular commodity can be reasonably expected to have a significant impact on U.S. exporters of that or a similar commodity. Activities likely to have a significant impact on exports of U.S. agricultural commodities to third country markets will not be funded. AID has issued a policy statement and guidelines to its Washington offices and overseas missions. AID does not view the Bumpers Amendment as a constraint to its overall goal of helping developing countries achieve food self reliance. AID assists a country in obtaining this status by supporting (1) the production of agricultural commodities that are economically viable to produce, (2) more efficient food distribution, (3) expanded purchasing power, and (4) selected international trade.

Health

Malaria Vaccine. Malaria continues to be one of the most widespread diseases, and in some countries the primary public health problem. AID is continuing its support of the Malaria Immunity and Vaccine Development research project, at a level of $10 to $11 million per year. The U.S.-based clinical trials of the anti-mosquito stage vaccine developed at New York University are scheduled to begin by October 1, 1986 at the University of Maryland School of Medicine. Six laboratories have completed the development of anti-red blood stage prototype vaccines that will begin U.S. non-human primate trials mandated by the U.S. Food and Drug Administration (FDA) before the end of 1986. In the past year, AID held the last of three regional conferences to determine sites and research protocols for future field trials of prototype vaccines; the trials should begin within the next 18 to 24 months. Sites for the field trials in Asia will be selected in early 1987 and epidemiologic data collection will be initiated. The third conference, to discuss malaria vaccine field trials in the Africa Region, was to be held at Washington in December, 1986.

Vaccine Development. AID continues to give special attention to improving vaccines for use in the health programs of developing countries. This work is being carried out through the National Institutes of Health (NIH), the Centers for Disease Control (CDC), the World Health Organization (WHO), the International Center for Diarrheal Disease Research in Bangladesh (ICDDR,B), and a variety of U.S. universities and research institutions. The vaccines currently being developed or tested with AID resources include the following.

1. Measles. A measles vaccine, grown in human diploid cells rather than chick-embryo fibroblasts, that can be given to infants as young as six months old is being studied. The present measles vaccine is not effective in infants less than nine months old, at which age the child may have already been infected.

2. Pertussis. A vaccine for whooping cough consisting of an acellular preparation that eliminates the pertussis vaccine side effects that now discourage mothers from completing the DPT immunization series is being studied.

3. Typhoid fever. A genetically engineered oral vaccine and a polysaccharide injectable vaccine for typhoid are being developed. Typhoid is responsible for a considerable number of deaths worldwide, and the organism has become resistant to most antibiotics in several parts of the developing world.

4. Cholera. An oral vaccine for cholera, the most severe of all the diarrheal diseases, is under investigation. Cholera affects an estimated 20 to 24 million people worldwide.

5. Viral diarrhea. A vaccine for rotavirus, the most common cause of diarrhea in the U.S., as well as in the Third World, is being studied.

6. Child-birth fever, fetal and neonatal infection. Group B streptococcus vaccines that may protect against fetal wastage, intrauterine infections, and low birthweight.

7. Pneumococcal pneumonia. Streptococcus pneumoniae is an acknowledged leading cause of infant and young-child deaths due to pneumonia in developing countries. A vaccine currently exists that is effective in older children and adults, but improvements are needed to make it effective in infants and young children infected with disease strains prevalent in the developing world.

8. Leprosy. Research leading to the production of Mycobacterium leprae vaccine by genetic engineering methods. The goal is to improve present vaccine production techniques, which are expensive, difficult and to date ineffective for leprosy (Hansen's disease), and require production of the leprosy organisms in armadillos.

In FY 1986, AID allocated over $5 million for these activities.

Vector Biology and Control (VBC). AID funded a project in VBC to assist Agency Missions overseas with malaria, onchocerciasis, schistosomiasis, and other vector-borne disease problems. The project provided technical assistance, support to operational field research, training, and program development. During its first year of operation, this project responded to requests from 15 countries for assistance that has resulted in improved health services and projects. This activity also is establishing a worldwide data management system for international use in vector control activities.

Child Survival. The emphasis of the AID health program during FY 1986 was redirected to focus on child survival. With additional funds appropriated by Congress, AID launched its Child Survival Action Program, and in April, 1986 issued its strategy for achieving a variety of child survival targets. These included developing the sustained capacity to provide immunizations for all the world's children, and making ORT available to virtually every child needing it.

The AID Child Survival Strategy is designed to significantly reduce the number of child deaths in LDCs by the end of the decade. While oral rehydration therapy and immunizations are the twin instruments for achieving this goal, birth spacing and a focused nutrition package emphasizing breastfeeding, improved weaning practices, and growth monitoring are seen as integral elements of the overall strategy.

1. Oral Rehydration Therapy (ORT) and Diarrheal Diseases. ORT, an important component of the Child Survival Action Program (CSAP), is a major weapon for combating ill health among a large portion of the world's children under five years of age who have three or more potentially life-threatening diarrheal episodes each year. It is one of the principal technologies promoted by AID in its CSAP worldwide. Currently, AID supports 131 ORT activities in a total of 53 countries. In FY 1986, 15 new bilateral projects supporting ORT activities were funded. The expenditure level for ORT increased from $12.7 million in FY 1983 to $36.7 million in FY 1986.

   AID is funding a new program, Project SUPPORT, to encourage private sector production of oral rehydration salts in selected countries. It provides low interest loans to local pharmaceutical companies and develops guidelines for private sector production. AID currently is working in 5 countries and plans work in up to 10 additional countries. Since less than 10 percent of the world's children have access to the salts, this project will enhance greatly AID ability to expand ORT programs.

A second International Conference on Oral Rehydration Therapy (ICORT II), held at Washington in December, 1985, was a major collaborative effort by AID and other health and development agencies around the world. The conference focused on the problems, issues, and lessons learned in establishing and implementing ORT programs. Approximately 1200 experts on ORT from over 90 developing and developed countries participated.

AID provided $3.1 million in FY 1986 to the International Center for Diarrheal Disease Research in Bangladesh and $1.5 million to WHO for basic, clinical, and epidemiologic research on diarrhea and its control and prevention. Another five-year project, Applied Diarrheal Disease Research, was funded at $9.5 million to better coordinate current AID support for diarrheal disease research. In addition, AID is continuing its four year $2.8 million grant to the International Center for Infant Nutrition and Gastro-Intestinal Diseases of the Children's Hospital of Buffalo, New York. The Center is training LDC pediatricians to conduct research on chronic diarrheal diseases.

2. Immunization. Immunization programs could prevent up to 3.5 million deaths in developing countries and constitutes, therefore, one of the major components of refocussed health strategy at AID. The agency is collaborating with WHO, UNICEF and other donor agencies in the international effort of universal immunization. Specifically, AID is seeking to immunize 80 percent of the children in AID-assisted countries by the end of 1990.

AID is supporting immunization projects in a total of 23 countries. In addition, there are 55 countries that have immunization as a part of the overall health programs. In FY 1986, 124 immunization activities were funded at a total cost of $54.4 million, more than double the level of support in FY 1985.

The Resources for Child Health (REACH) project serves as one primary mechanism for implementing AID global immunization strategy. REACH provides technical assistance to strengthen the immunization components of primary health-care systems in developing countries.

The Combatting Communicable Childhood Diseases Program (CCCD) in Africa is another major component of the immunization strategy that will provide greater than $20 million in support of immunization activities. Through this initiative, Africa's national childhood disease programs in the health-delivery system will be strengthened and expanded in order to reduce childhood mortality.

Health Care Financing Program. Critical to AID assistance policy is the promotion of financially sustainable health programs in AID-assisted countries. AID has been aggressively pursuing health financing initiatives as a major component of the child survival strategy, and Health Financing Guidelines have been developed. These guidelines stress the importance of efficient and equitable use of limited health resources, and advocate a variety of cost-recovery measures, as well as involvement of the private sector in establishing alternative health-care delivery systems.

Over $2.0 million was targeted specifically for health financing activities as part of the REACH project. In less than a year of operation, REACH has received numerous requests for technical assistance and has responded to more than 30 countries. Specific examples of assistance now underway include a four-country study in the Latin America and Caribbean Region on user fees, a comparative cost-effectiveness analysis of routine versus mass campaign immunization programs in Ecuador, analyses of potential mechanisms for cost recovery in Zaire, and development of private sector Health Maintenance Organizations (HMOs) as an alternative to government subsidized health care in Indonesia.

AID also is providing funding to WHO to undertake a study of recurrent health-care costs in three countries. The objectives of the study are to establish a framework for assessing resource allocation within the health sector, identify unit and operating costs associated with specific health programs, and recommend alternatives to financing the Health Care For All by 2000 Strategy.

Vitamin A Deficiency. AID is validating laboratory results on vitamin A deficiency through a program of field tests in developing countries. The research results of an 18-month study in Indonesia on the effects of supplementation in reducing the clinical signs of vitamin A deficiency on the general health status of children are providing specific data. This study revealed that children who are mildly vitamin A deficient (i.e., without clinical symptoms of vitamin A deficiency) develop respiratory disease and diarrhea at two and three times the rate of children with supplemental vitamin A intake. The mildly vitamin A deficient children have a mortality rate that is four times higher than children with vitamin A supplementation. These dramatic results indicate that inexpensive, easily delivered programs to prevent vitamin A deficiency could have an important effect on reducing early childhood morbidity and mortality, as well as preventing blindness.

Operations Research. Health programs are complex systems that vary widely in their cost and effectiveness. The objective of the operations research program at AID is to provide detailed insights into the performance of child survival programs, and to develop concrete responses to the shortcomings that are identified. The program is developing a set of observations that can be applied to child survival programs generally, particularly in areas that rarely are addressed through evaluations and management systems. Studies also are developing practical techniques that can be used by health-program managers to analyze and respond to problems in service delivery. While the immediate focus of the program is on child survival interventions such as ORT and immunizations, the operations research approach to identifying and improving service delivery equally is applicable to other health technologies.

Population

Contraception Development: A New 90-Day Injectable Contraceptive. The development of new and improved methods of fertility regulation that are safe, effective, and acceptable presents a formidable challenge to the population field. One of several approaches being followed is the development of long-acting injectable contraceptives for women.

Over the past several years, significant progress has been made in designing an injectable system that uses the synthetic hormone norethindrone encapsulated in a biodegradable lactide-glycolide copolymer. Norethindrone is one of the most widely used progestational hormones in oral contraceptives, and almost 20 years of experience has demonstrated its safety. The biodegradable co-polymers used in the system are similar to the polymers widely used in biodegradable sutures. This new system, which has a 90-day duration of action, currently is being tested in the U.S. (i.e., Atlanta, Jacksonville, Miami, New York and Pittsburgh) and in Santiago, Chile and Rome, Italy. No pregnancies have occurred, and the major side effect is some menstrual bleeding and spotting irregularity. The major advantages are that the system contains no estrogens, it is long-acting, it can be delivered by non-physicians, and it should be fully reversible.

The next steps in the development of this system are to scale-up production of microspheres of hormone and polymer, and to simultaneously undertake the final stages of toxicity testing in animals and expanded clinical trials in women. In addition to the 90-day preparation, research also is progressing on development of 30- and 180-day systems.

Energy

Research and Technology Development. Energy activities of AID reflect a conviction that research and technology development has made, and will continue to make, far-reaching and lasting contributions to economic and social progress in developing countries. Recognizing the experience of East Asia, the strategy advocates that rapidly modernizing societies place increased emphasis on technology development and innovation. Active involvement of the private sector is critical for ensuring the relevancy of a technology development and innovation program.

Energy activities by AID include R&D in innovative power systems for developing countries using indigenous coal, gas, hydropower, biomass and other renewable sources. These systems have been successfully developed and used in the U.S. by consortia involving the S&T community centered in universities and national laboratories, equipment manufacturers, utilities, developers, and investment bankers.

The relevance of this experience to rapidly modernizing countries, particularly in Asia, is explored by AID through involving private utilities and research consortia in its energy assistance programs. A new project in India stresses a market-driven approach to indigenous R&D, with a view toward quickening the pace of technology commercialization in the power sector. The $20 million Energy Research and Enterprise project in India will support selected research and technology development proposals, while seeking to create an institutional environment for relevant technology innovation in the energy sector.

The first project in the AID portfolio to make the link between technology innovation and enterprise was the Program for the Advancement of Commercial Technology (PACT). PACT is designed to promote Indo-U.S. joint ventures in technology development, and heighten the enterprise sector's interest in building research and technology development programs. It has attracted wide attention in both the U.S. and India.

Energy Conservation. The Energy Conservation Services Program in FY 1986 evaluated the potential for development of nonutility power generation options, such as cogeneration, by both the U.S. and private sector in Pakistan, Thailand, and India. Successful development of such options will increase the use of domestic fuels, improve fuel efficiency, and enhance the resiliency and reliability of power supplies. It also will provide opportunities for private sector investment in areas traditionally not available, including cooperative R&D and technology transfer.

A technology transfer advisory team has been formed to advise AID on how to facilitate the transfer of technology from the U.S. private sector to cogeneration projects in developing countries. The team is comprised of technical experts from U.S. firms, and team activities include identifying opportunities and constraints to technology transfer, designing information dissemination initiatives, and initiating marketing and training efforts.

AID also is working with the private Association of Indian Engineering Industries on a program of collaborative research. The technical efforts are focusing initially on waste heat recovery, cogeneration, and boiler and furnace design, manufacture and control. Total funds obligated in FY 1986 under the Energy Conservation Services Program was $651,000.

Indigenous Energy Resources: Renewable Energy. Determining the potential for small-scale, decentralized technology using renewable energy resources has received considerable attention by AID missions. Projects in Asia, Africa, and Latin America have tested solar, wind, biomass, biogas, and small hydrologic technologies for meeting rural and village energy needs. These tests have helped develop a core of experts at energy centers who understand the potential and the problems of renewable energy technologies. AID initiated in FY 1986 an assessment of information learned from more than a dozen years experience in renewable energy applications. This assessment includes lessons learned about both renewable energy technologies and project management. Preliminary recommendations concerning future directions for AID renewable energy activities will be included.

Indigenous Energy Resources: Household Fuels. AID programs are researching alternatives to fuelwood for domestic and commercial use, in addition to efforts to improve the availability of fuelwood and technologies to use household fuels more efficiently. In Uganda, charcoal briquettes from coffee husks are produced in a cooperative plant designed to use nonmechanical processes that maximize labor input. In Kenya, more than 6,500 charcoal-conserving metal stoves per month are being manufactured by private entrepreneurs as a result of the AID $4.8 million Kenya Renewable Energy Project. More than 40,000 of the stoves, which incorporate a clay liner adapted from stoves used in Asia, have been fabricated and sold. AID contributed technical assistance and training to this effort.

A program in Pakistan is exploring ways to increase supplies of clean-burning coal-based briquettes as household fuel substitutes. Market size, price, and consumer behavior issues are being evaluated. Government policies, appropriate business arrangements, and financial viability also are being analyzed.

Indigenous Energy Resources: Coal. A feasibility study for a major coal development effort in Pakistan was completed in FY 1986. Results are being evaluated. Request for proposals from the private coal mining sector to produce and sell Lakhra coal to a power plant is a possible outcome of this study. However, the poor quality of the Lakhra coal may limit the size of the power plant. AID will assess the technology of large scale installations of fluid-bed combustion generators for possible application at Lakhra.

A reassessment of the feasibility of a coal-water-fuel power plant in the Philippines was initiated in light of the decline in world oil prices and the change in government. Preliminary results appear attractive. A major U.S. coal company has expressed interest in investing in a Philippine coal property.

AID continues to monitor technological developments in coal conversion. These developments are aimed largely at the environmentally acceptable coal burning technologies such as fluid-bed combustion, coal gasification, new methods for cleaning coal, and combined-cycle power generation. Much of the work in this area has been carried out by the U.S. DOE and the Electric Power Research Institute.

Technologies such as fluidized-bed hold significant promise for the use of India's coal resources that are the largest in the developing world, but are low in energy content and high in ash. An R&D effort is underway to develop technologies to beneficiate these lignites and convert them to heat and power. A collaborative research program is on-going between the U.S. DOE Pittsburg Energy Technology Center and several Indian coal research centers in beneficiation, fluidized-bed performance, lignite combustion, and lignite gasification.

Coal also is a major emphasis of Indonesian plans to diversify domestic energy resources. AID is supporting the establishment of the Puspitek National Energy Laboratory, which will work with government and private organizations in carrying out technology assessments and coal equipment testing. The laboratory will serve as a catalyst to the transfer of U.S. technology in coal-fired boilers.

Indigenous Energy Resources: Oil Shale. Some countries lack indigenous energy resources and must depend almost totally on imported oil for their energy supply. A few of these have oil shale resources, but use of the retorting process of oil shale for petroleum has not proven to be economically feasible. A new approach to direct combustion of oil shale has opened up the possibility of using such resources. The approach embraces the circulating fluidized-bed combustion technology for producing steam and electricity using ground up oil shale as if it was coal. AID is studying the feasibility of using oil shale in Jordan to produce electricity. Jordan imports oil at a cost of $180 million annually for the production of electric power. Successful development of the oil shale resource would provide tremendous foreign exchange savings. The AID funding for the feasibility study was $261,000.

Indigenous Energy Resources: Bioenergy. The Bioenergy Project provides programmatic and technical support to developing countries for developing and improving bioenergy resources. The bioenergy program budget for FY 1986 was $920,000.

A program was initiated in some Asian rice-growing countries to expand the efficient use of rice hulls and rice straw in energy applications. Combustion of the residues, and conversion of the cellulose to sugars both have been examined. Technological advances make it possible to burn rice residues by direct combustion for steam or electric power in either relatively small (3 to 5 MW), or larger (10 to 25 MW), power stations.

A survey trip to Asia identified considerable potential for 4 to 10 MW plants burning rice residues in the Philippines and Indonesia. A joint proposal is being developed with the International Rice Research Institute in the Philippines to further define a system for producing ethanol by the acid hydrolysis of rice husks. Tests have been conducted at the Tennessee Valley Authority (TVA) research facility to determine the potential for converting rice husks to ethanol using the TVA "agri-refinery" system. The results show positive potential.

The cane energy assessment program is beginning to mature. A feasibility study of the technical and economic potential for production of electricity in the Jamaican sugar cane industry has been completed. Results of the study indicate favorable economic returns to Jamaica, foreign exchange savings from the displacement of imported oil, and the potential to revitalize the country's largest agricultural industry. It seems likely that the Bechtel Company will offer the Jamaican government a proposal to invest in a 35 MW cane fired power plant at a cost of about $50 million. If accepted, this could be the forerunner of additional projects.

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The bioenergy activities of AID assist in the development of technical capabilities necessary for economic development in assisted countries. The U.S. benefits in terms of performing research in new biotechnology areas. Technical cooperation in areas of particular U.S. expertise helps build trade relationships with the developing world.

Indigenous Energy Resources: Training. A lack of trained personnel to identify, explore, and manage indigenous energy resources in developing countries is a problem. To help build host country energy capabilities, academic or on-the-job training has been provided to more than 500 LDC nationals in areas such as petroleum geology, energy economics, electric utility engineering, and energy conservation. Responsiveness to the needs of a developing country is illustrated by a trainee from Bangladesh. Bangladesh has a vital natural gas development project, but lacked a well log interpretation specialist. The project sponsored a trainee to study well log and open hole log interpretation in the U.S. Acquired skills enabled the trainee to oversee the start-up of two new wells. The trainee has since developed a well logging course at the University of Bangladesh.

A course in energy conservation for in-plant engineers trained a participant from New Delhi. Upon returning to India, the trainee implemented conservation measures in a factory that saved about 70 tons of furnace oil a week, or an annual fuel savings of more than $700,000. In Costa Rica, a bus and taxi driver energy efficiency training program has resulted in a 20 percent fuel savings for the fleet.

The training program offers excellent opportunities to enhance the S&T aspect of U.S. foreign policy. The program, however, cannot meet the increasing requests from developing countries for training assistance because of budget decreases. The FY 1986 budget for the training program was $1.6 million, a decrease from $2.1 million in FY 1985.

Forestry

Forestry Research Network. The Forestry/Fuelwood Research and Development (F/FRRD) project initiated activities during FY 1986 in Asia. AID-sponsored experts in tree species research, social science, and research coordination are now based in Bangkok, Thailand. Their activities include support of research network activities linking work in about ten countries consisting of improved research methods and information management, research collaboration among Asian countries, workshops and conferences, research execution, and research planning and management. A second phase of the project that will support fuelwood recently was initiated with the International Council for Research in Agroforestry (ICRAF).

Research and selection of multi-purpose tree species (MPTS) for agroforestry systems in Africa was continued in conjunction with national institutions. A later phase of the project will involve developing countries in Latin America in similar research-strengthening and networking programs. A global research component will link regional efforts and provide for state-of-the-art research in selection, improvement, biotechnology, environmental models, and socio-economic aspects of MPTS.

In Latin America, the F/FRED project is being linked with the ROCAP Tree Crop Production project. This effort emphasizes research on socioeconomic aspects of tree crop technologies and the use of MPTS in short, rotation forestry. The project also continues the ongoing efforts of institution strengthening, education, extension, and market-oriented tree crop technologies. Similar linkages are being formed between the F/FRED project and the proposed Forestry Education, Training and Extension project in India. In FY 1986, $2 million was allocated for this activity.

Forestry Private Enterprise Initiatives. AID continued to carry out a new forestry private enterprise initiative during 1986 that is designed to provide guidance and direction to private enterprise projects dealing with wood-using and forest-based businesses in LDCs. Applied research undertaken during 1986 included development of forestry investment profiles in Ecuador that will stimulate interest in private reforestation and examination of growth constraints faced by small wood-producing enterprises. Other research efforts are being undertaken in the areas of trade barriers to timber-product export in Southeast Asia, fiscal incentives for forest plantations, and development of an import substitution model for softwood lumber in Jamaica. The development of a forest products export market was based in Ecuador to carry out a demonstration of the economic benefits attendant to forest products industry development. The project has succeeded in brokering formation of a consortium comprised of groups involved with Ecuadorean forest products and U.S. design and marketing services. This accomplishment holds the promise of increased local production, employment, and exports. Approximately $200,000 was allocated to this activity in FY 1986.

Technical Strengthening of Reforestation Project. The Peace Corps implemented a new agreement to provide technically trained forestry volunteers to work on P.L. 480 Food Program reforestation projects in LDCs with private voluntary organizations, the U.N. World Food Programme, and host government organizations. Technical design and programming missions dispatched to Senegal, Rwanda, and Kenya during 1986 succeeded in identifying placements for more than 30 additional specially trained forestry volunteers. They would work within private voluntary organizations in the food-for-work village forestry projects. Efforts are now underway to develop new technical and programmatic training models for entering volunteers in P.L. 480 projects within private voluntary organizations. Technical aspects focus on raising survival rates of seedlings through utilization of improved tree seed and plant material matched to local environments, local needs, and end uses. In FY 1986, $1 million was obligated for this project.

Additional AID Activities in S&T

Biologic Diversity: An Interagency Report to Congress

As lead agency for the Interagency Task Force on Biological Diversity, AID submitted a progress report to Congress in February, 1986 on initiatives undertaken to implement the recommendations of the 1985 U.S. Strategy on the Conservation of Biological Diversity. Approximately 102 actions by AID or other federal agencies were identified that relate to various aspects of assisting developing countries conserve and manage the diversity of their living resources. The identified actions covered a wide range of categories including policy dialogue, institution building, training, education, research, technology transfer, resource management, and cooperation with nongovernmental organizations. Major activities within AID included the initiation of a Biological Conservation in Development project funded at $250,000 to provide technical assistance, training, and other support functions for AID and developing country personnel; the development of an NGO/PVO (nongovernment organization/private volunteer organization) small grants program on conservation in the Near East funded at $66,000; a grant to the International Program of The Nature Conservancy ($266,000) for the development and networking of conservation data centers in selected Latin American countries; and a matching grant to World Wildlife Fund-U.S. for the development of a project focusing on the relationship between wildlands maintenance and the development needs of local populations funded at $335,000.

Strengthening Environmental Non-Governmental Organizations

Increased participation by non-governmental environmental organizations in national decision making in developing countries can lead to increased attention to ecologic factors in the planning process and to improved implementation of activities at the local level. AID is assisting indigenous groups to build their scientific and administrative capabilities. Grants and technical assistance have been provided to groups in the Philippines, Thailand, Ecuador, Panama, Bolivia, Turkey, and in the Caribbean region. Exchange of information and experience among these groups is another useful form of institution building and technology transfer, and AID is providing support for meetings to encourage this exchange.

Program in Science and Technology Cooperation (PSTC)

The Program in Science and Technology Cooperation (PSTC) obligated $10.3 million in new funds in 1986 for innovative research activities in developing countries. The program was started in 1981 as a U.S. initiative following the U.N. Conference on Science and Technology for Development. The program remains implemented through two mechanisms, a competitive research grants program administered directly by the Office of the AID Science Advisor and a research networking program implemented through a grant to the National Academy of Sciences (NAS). Both programs have been favorably evaluated by the Research Advisory Committee of AID in the last year.

Competitive Research Grants Program

The program continues to provide modest-size research grants, primarily to developing country researchers. Emphasis is on biotechnology in plant and animal systems, chemistry in agriculture, biomass conversion, and biologic control of vectors of certain plant and animal diseases.

This year however, a new research module was announced -- "diversity of biologic resources". Four projects were funded in the new module. As an example, a grant was made to the

Department of Veterinary Services of the Malaysian government to study the potential of gaur-cattle hybrids. The gaur is a wild bovine species, now found only in scattered remnant herds in the hill forests of south Asia, that according to NAS "would seem to be an ideal meat producing animal". While the gaur was thought not to be capable of interbreeding with cattle, a government station in Malaysia last year found itself with a number of hybrid calves due to a gaur bull that jumped a fence and mixed with a herd of cows. They sought financing from the PSTC program to follow up on the unique opportunity to introduce into commercial beef production the germplasm of a large meaty animal perfectly adapted to tropical climates.

The grants program funded 48 new projects during FY 1986 for a total of $5.7 million, with 31 of the grants going directly to developing country institutions. Some 405 pre-proposals were received, so that only about 12 percent of candidates are being funded this year.

Some initial projects are beginning to demonstrate the potential of the program even though it is still very young. In 1983, for example, a grant was made to the Pan American Health Organization (PAHO) to share in the expenses of developing a computer system for translating English into Spanish. The project was completed successfully this year, and the system has been used already by PAHO to translate about one million words of text. Their estimate is that the system reduces the person hours for translation by about two-thirds, and can make even more dramatic improvements in the time needed to produce a published report. The system has been installed on the AID computer, and efforts are underway to disseminate the technology to other users. The potential advantages to the U.S. of more rapid translation are obvious.

Another funded project allowed a Florida International University scientist and colleagues to study the potential use of seagrass for restoring the productivity of near-shore areas that have been damaged by pollution. Successful experiments in Jamaica impressed that government, and a $500,000 project has been initiated to use unemployed fishermen to restore parts of the coastline. The Food and Agricultural Organization has funded the same scientist to replicate the experimental demonstration in the Philippines, and more recently has asked her to teach the approach to representatives of a variety of Asian countries. Thus, there is a demonstrable transfer of U.S. technology to solve a visible problem in a number of developing countries. This is a specific case of a project that has scientific, ecologic, and political benefits to the U.S. at very small cost to the taxpayer.

In another example, Israeli researchers in collaboration with colleagues at the International Potato Center (CIP) in Peru have been working with protoplast fusion technology. An ideal for plant breeders has been to replicate the strategy implicit in hybrid corn. Vigorous, improved hybrid corn does not deteriorate in quality with subsequent plantings since the hybrid plant has male sterility and will not self-pollinate. In trying to produce hybrid true-potato seed, CIP researchers have been frustrated by the fact that male sterility genes have not been associated with high producing varieties of potato. However, an Israeli investigator noted that the trait was associated with the mitochondria, and not with the nucleus of the cell. Consequently, he has used protoplast fusion techniques to transfer mitochondria from the cytoplasm of male-sterile lines into top seed-parent lines. Field tests are currently being conducted to determine if the resulting new lines will combine all the desired characteristics. Even if the desired results are not yet achieved, the project has produced a brilliantly original scientific approach.

A grant of $185,000 has funded nearly four-and-a-half years of research on the Babassu Palm. The palm produces abundant amounts of oil similar to coconut oil, as well as charcoal and a variety of other products used in traditional communities. The palm covers 13 or 14 million hectares of land in the Amazon basin, but it has never been domesticated. Research has demonstrated that wild plants can produce up to 100 liters of oil per hectare, but suggests that with appropriate breeding and cultivation it should be possible to increase yields by a factor of five or more. Perhaps most important, the palms are so vigorous that they have spontaneously colonized large areas of agricultural lands that were overfarmed, depleted, and abandoned. This research has demonstrated the potential to restore degraded tropical lands to economic productivity using a relatively little known wild species. Moreover, the effort has opened lines of communication between American and Brazilian scientists that are useful to both countries.

A grant for a cooperative project between Johns Hopkins University and the Ministry of Health in Liberia has greatly clarified the taxonomy and behavior of the black flies that carry river blindness in Africa. The project is being followed up with additional research by two African doctoral candidates supported by the WHO, and a special project on black fly vector control on the Firestone Rubber Plantation. The $240,000 project to date has resulted in 15 articles published or accepted for publication in peer-reviewed scientific journals, and in two completed Ph.D. dissertations.

The International Foundation for Science (IFS) receives $200,000 per year from the Program in Science and Technology (PSTC). The IFS is a non-governmental organization with NAS and its foreign counterparts as members; it makes grants of up to $10,000 per year to young scientists from developing countries for research in their own country. The U.S. participates with a number of other donors in supporting this organization, and provides about 10 percent of the budget for grants; there is no overhead charged to the U.S. In 1986, the IFS received the King Baudouin International Development Prize for the originality and effectiveness of its action. The prize carries nearly $100,000 and is a unique tribute to the quality and effectiveness of this small program.

The National Academy of Sciences (NAS) Program

NAS awarded 13 new grants in FY 1986, and ten additional grants were approved and probably will be signed in early FY 1987. The NAS program continues to focus on six research networks in developing countries encompassing acute respiratory infections in children, mosquito vector control, rapid means of epidemiological assessment, fast growing trees, biologic nitrogen fixation, and grain amaranth. In addition to an AID review, the NAS research program received a favorable evaluation by an independent panel of the NAS Board on Science and Technology for International Development.

Results from this program illustrate its potential long-term impact. Biologic nitrogen fixation has been a research priority in order to find ways for poor farmers in developing countries to avoid the high costs of nitrogen fertilizers. While effective nitrogen fixing symbiotes are known for many legumes, this is not the case for grasses. Since many of the most important food crops such as grains and sugar cane are grasses, it is important to understand grass-associated microorganisms that fix nitrogen. Some NAS-supported researchers have proven that under appropriate conditions biologic nitrogen fixation is a major contributor to nutrition of Kaller grass in Pakistan and to a sugar cane variety in Brazil. They now are proceeding to quantitate the amount of nitrogen fixed and the strains of bacteria responsible. This appears to be a major scientific breakthrough that was facilitated greatly by working in the environments in which the relevant organisms naturally function. Kaller grass has the additional interesting property of thriving on saline soils where few other plants can survive, and seems to offer great promise for land reclamation.

In Kenya, researchers isolated nitrogen fixing rhizobia that are active at higher temperatures than previously reported. This offers the possibility of increasing the inoculation success in tropical soils subject to high temperatures, and of increasing the survival of inoculants stored in warm conditions prior to application. Complementary work by researchers in Kenya and Brazil has demonstrated that the efficiency of nitrogen fixation in Rhizobium species-legume systems is influenced by the variety of legume. The researchers are beginning to develop techniques to breed new varieties of legumes that combine vigor and effective nitrogen fixation symbiosis.

Mexican molecular biologists have succeeded in transferring the nitrogen fixing capability of rhizobia to another bacteria, Agrobacterium species. The ability to transfer nitrogen fixing capacity to other organisms is now being used in an attempt to genetically engineer rhizobia associated with the common bean. Up to now the bean has shown little ability to fix nitrogen although it is an important food crop in many nations.

Some success has been achieved applying industrial quality control methods to public health programs in attempts to develop methods of rapid epidemiological assessment. A project in Peru has applied lot quality control methods to evaluate the effectiveness of health services and determine prevalence of malnutrition. The approach reliably provides important data more quickly and inexpensively than would be possible with traditional epidemiologic approaches. The method now is documented in a working manual, and the researchers are collaborating with Peruvian Ministry of Health workers to institutionalize the method in Peru.

Another application of rapid epidemiologic assessment is for determination of community risk. Researchers in Guatemala, have developed a "sentinel" warning system. School teachers are trained to measure pupils' height, and averaged results are used to predict the prevalence of malnutrition in the community. Similarly, a Brazilian group takes data from routine autopsies on children to assess the state of the community's vitamin A nutrition. Both projects provide new sources of public health data with very low costs to health planners.

Like the complementary competitive research grants program, the NAS research program provides a highly visible expression of U.S. interests and cooperative approaches at relatively low cost. It is noteworthy that two NAS grantees won major scientific awards in their own countries in 1986. Luis Sumar who is working on breeding improved cultivars of grain amaranth was awarded the Peruvian Order of the Sun by President Garcia. He is the first civilian recipient of that decoration. In Thailand, Dr. Sakol Panyim is working on DNA probes to distinguish among related species of malaria vector mosquitos; he was named Scientist of the Year by the Institute for the Promotion of Science.

The NAS also produces a series of monographs under this program on innovative technologies for developing countries. The most recent deals with the applications of microcomputers in developing countries. The monograph was made available to a commercial publisher in the U.S. for sale in the domestic market, and is being distributed widely without cost to developing country S&T policy officials. This could help encourage policies to more actively acquire and utilize microcomputer technology for solving development problems.

U.S.-Israel Cooperative Development Research (CDR) Program

AID was chartered by the Congress in FY 1985 to develop a new program to fund the application of relevant Israeli technology for developing countries. That program has been expanded. In FY 1986, 188 pre-proposals were received and 33 grants were awarded for a total of $4.8 million.

While the program is open to any team of developing country and Israeli scientists, projects are encouraged in areas where Israeli technology is seen as particularly outstanding and relevant to the needs of the poor countries. The 537 pre-proposals received, and the 46 projects funded in the first two years of the program, may be broken down as follows:

AREA	PRE-PROPOSALS	FUNDED
Arid lands agriculture	74	7
Biologic pest control	54	9
Human health	65	7
Engineering/food science	105	9
Plant science/biotechnology	87	4
Veterinary/animal science	35	4
Water (aquaculture/hydrology)	73	6
Other	44	--

Cooperation to date has been funded between Israel and 15 developing countries, including six African, five Latin American, three Asian nations, and Portugal. Efforts are made to assure that there is real collegiality between Israeli and host country scientists, and that the program may be expected to make a useful contribution to increasing understanding between Israel and countries of the developing world.

The program is managed by AID to assure visibility for both beneficiaries, and to assure the cooperation meets U.S. development assistance goals in the host countries. Proposals are judged on scientific merit, relevance to development, innovation, and contribution to the research capacity of the developing country. High quality projects are particularly encouraging.

Researchers from Ben Gurion University, for example, are working with colleagues in Botswana to develop systems in which perennial shrubs can be used to improve pastures; Israeli expertise in arid lands management is being applied to developing ecologically sound grazing systems for southern Africa. Researchers from Hebrew University are working with colleagues from Guinea to use recombinant DNA techniques for developing varieties of Bacillus sphaericus that may help control disease-carrying mosquitos. Israeli high-technology is providing new techniques through this project to solve the growing problem of insecticide resistant vectors. Researchers from Tel Aviv University are working with colleagues with complementary skills from Mahidol University to develop and evaluate sulfonamide drugs as male anti-fertility agents.

Personnel Resources for S&T

Centrally funded S&T activities totalled $261 million in FY 1986. To manage these activities, AID draws extensively on consultants and contractors from the U.S. scientific community as well as other government agencies to provide technical expertise in specific technical disciplines. Approximately one-quarter of the 3,131 U.S. direct-hire employees of AID are qualified to serve in scientific or technical positions in AID/Washington bureaus and field missions overseas.

Chapter 15 - BASIC SCIENCE AND ENGINEERING

Overview of National Science Foundation's International Activities

The National Science Foundation (NSF) is an independent Federal agency established by the National Science Foundation Act of 1950 (P.L. 81-507) to promote and advance scientific and engineering progress in the U.S. The Act also assigns to NSF broad responsibility for encouraging participation of U.S. scientists and engineers in international activities, and grants authority to the NSF Director to engage in science and engineering negotiations with foreign countries and multilaterial bodies consistent with U.S. foreign policy, as defined by the President, the Secretary of State, and the Congress [Sec. 13(b)(1)].

The NSF supports international activities of U.S. scientists and engineers to further three related objectives: (1) to facilitate access by U.S. scientists and engineers to unique research facilities, unique localities, and outstanding foreign scientists and engineers; (2) to facilitate the study of large-scale natural phenomena (such as atmospheric, oceanic circulation, or geologic features) that transcend national boundaries, and thus define research fields that are intrinsically international; and (3) to help advance specific U.S. foreign policy and national security objectives, as defined by the President, the Secretary of State, and the Congress.

In addition to supporting science and engineering research, NSF is required by law to collect, analyze, and disseminate a wide variety of research and development (R&D) data. These data are published biennially in the National Science Board's Science Indicators series, as well as in other publications.

The scope and detail of the Foundation's international data collection and analysis program expanded during FY 1986, particularly for Western Europe and Japan. NSF also continues to assist the Organization for Economic Cooperation and Development (OECD) in its data collection and analysis efforts, and with standardizing definitions of various classes of R&D data to facilitate better cross-national comparisons. In addition, as part of its objective to assist the Director of NSF with international policy matters, and based on the 1985 recommendation of the Committee on International Science of the National Science Board, development was continued on approaches to more systematically assess "areas of excellence" in science and engineering outside the U.S.

Approximately 20 percent of 12,000 research grants awarded annually by NSF have an international component ranging from support for the participation of U.S. scientists and engineers in international meetings to participation in large multinational collaborative research projects. These grants can be divided into three categories:

1. Grants with international dimensions that are an integral component of the research. This category accounts for the largest number of NSF awards with international components, and receives support from the full range of NSF disciplinary units (i.e., engineering, mathematical and physical sciences, geosciences, and biologic, behavioral, and social sciences).

2. Grants for research in fields where the scientific problems typically are regional or global in scope. This category includes research supported by NSF units in earth, polar, ocean, and atmospheric sciences, in environmental and tropical biology, and in some of the social sciences, particularly economics.

3. Grants in which cooperation with a foreign scientist or institution is essential, and that meet the mutual benefits terms of the more than 30 bilateral S&T agreements managed by the NSF Division of International Programs (INT).

Grants with International Dimensions

Basic Science

The abundance of high-quality researchers and research activities in other countries has made international activities an integral part of the research in mathematical and physical sciences. Today, more than ever, the main impetus for most international collaboration in major areas of physics is the uniqueness of facilities, and the need for scientists to obtain access to international centers such as CERN in Geneva. NSF continued to support the work of U.S. elementary particle physicists in 1986 at CERN, the Deutsches Elektron Synchrotron in Hamburg, and the KEK High Energy Physics laboratory in Japan. Along with the Department of Energy (DOE), NSF also contributed support for some of the experimental apparatus used by these physicists. Counterpart organizations abroad likewise supported the activities of foreign physicists at U.S. elementary particle research centers, including the Cornell Electron Storage Ring (CESR) Laboratory, the Fermi Laboratory near Chicago, and the Stanford Linear Accelerator Center (SLAC).

International collaborative efforts also are becoming more common in intermediate energy nuclear physics, a field that is increasingly characterized by the complexity of instrumentation.

Instrumentation and facilities in other areas of physics, chemistry, and materials research rarely are so expensive as to require international cost sharing. However, there are many unique facilities and excellent people working in these fields abroad, particularly in the industrialized countries. The focus of international support by NSF in these fields continues, therefore, to be on cooperative small scale research projects, support of international conferences, seminars and workshops, and travel support for scientific meetings abroad.

In chemistry, for example, NSF continued to initiate many seminars and workshops in catalysis and bioinorganic chemistry throughout the world. These meetings were held in China, Japan, Australia, England, France, Italy, Belgium, Venezuela, Poland, and the USSR. Major international chemistry meetings of larger scope also were supported in the U.S. and abroad.

Important components of materials research involve a combination of scientist-to-scientist collaboration and collaboration fostered by unique facilities. NSF supported conferences and workshops, exchanges of U.S. and foreign scientists, and collaborative efforts in this area in FY 1986. About 10 percent of the users of NSF-supported materials research facilities (i.e., 30 to 50 foreign scientists) came to the U.S. on exchange programs. U.S. scientists also made productive use of facilities in other countries including the Federal Republic of Germany (FRG), France, Japan, and Denmark.

Other countries of particular interest to NSF because of their special capabilities in materials research are Australia (solid state electrolytes, materials engineering), FRG (ceramics and metallic systems, atomic microstructure studies of polycrystalline ionic and metallic materials, synthesis of solids), France (polymers, neutron scattering studies of metallic, amorphous, magnetic, and electronic materials, synthesis and characterization of new materials); Japan (high performance ceramics, advanced composite materials); Scandinavia and the Netherlands (fiber composite materials, electron microscopy, high temperature structural materials research, semiconducting materials), USSR (strategic materials, condensed matter theory, low temperature physics, superfluids, and superconductivity), India (solar cell materials, solid state inorganic chemistry), and the People's Republic of China (high performance ceramics, polymers, super alloys, amorphous metallic materials).

Project support for international cooperation in computer research has not been extensive to date, although scientist-to-scientist collaboration takes place. Most of this is with Western Europe and Japan, but activities with Israel and India also are significant. Collaborative efforts in FY 1986 included theoretical computer science and computer systems design with FRG and theoretical computer science and software systems science with Finland, Norway, Sweden, Israel, Italy, the U.K., and the Netherlands. One influential mechanism for international collaboration has been the Computer Science Network (CSNET) project that encourages membership by computer research communities in other countries. At present, there are several member institutions in Israel, Canada, and countries in Europe and Asia. An agreement was reached in FY 1986 between NSF and the Japanese Institute for New Generation Computer Technology (ICOT) for the Directorate for Computer and Information Science and Engineering to support U.S. scientists and engineers engaged in research at ICOT.

Support for international cooperation in astronomy shares some of the characteristics of the support for other physical sciences. U.S. and foreign astronomers cooperate in studies of stars, galaxies, stellar evolution, solar astronomy, cosmology, and in the development of instrumentation to facilitate those studies. However, astronomy also is geography-dependent. Almost half of all astronomical objects cannot be observed from the Northern Hemisphere. NSF continues to support the Cerro Tololo Interamerican Observatory in Chile and its use by U.S. scientists; other unique, foreign astronomical facilities also are available for cooperation.

International cooperation in mathematics is a traditional mode of interaction. A measure of the current importance of international cooperation to mathematics is that about 30 percent of all co-authored papers in recent years involved mathematicians from more than one country. Much of this international cooperation in mathematics is for short visits and conferences, or for academic terms at foreign universities. The Oberworlfach conferences in the Federal

Republic of Germany and the American Mathematical Society's Short Summer Conferences and Summer Institutes in the U.S. are of particular interest. Another important form of international activity is centered at major mathematics institutes, where programs involve foreign mathematicians. Included are institutes in Brazil, France, and the FRG, as well as the Institute for Advanced Study, the Institute for Mathematics and its Applications, the Mathematical Sciences Research Institute, and the Courant Institute, all in the U.S.

The fields of cellular and molecular biology also emphasize person-to-person exchange. These areas are critical to further advances in biotechnology, and NSF encouraged more international efforts during FY 1986.

NSF activities in the field sciences are characterized by support for research in more than 50 countries. These include studies of unique physical, biologic, and social systems such as the multilateral study partially supported by NSF that focused on the East African rift. Other such studies in various areas of the world were continued through FY 1986.

NSF awarded grants during FY 1986 to U.S. anthropologists for studies in 58 countries, and supported field research in systematic biology and ecology by U.S. scientists in more than a dozen countries including Mexico, Ecuador, Brazil, Venezuela, and Australia. A major effort in these disciplines focuses on the Organization for Tropical Studies in Costa Rica, a consortium of 30 institutions that NSF has supported for more than 20 years.

Many countries are restrictive of foreign scientific research in the field sciences at sites within their borders. U.S. scientists working in field sciences disciplines must continue to rely on information and assistance provided by U.S. embassies abroad and by the Department of State in Washington. Government-to-government arrangements for scientific research also encourage and facilitate access by U.S. scientists.

Engineering

The majority of NSF support for international work in engineering has involved participation in international meetings and short-term visits to foreign centers. During 1986, international engineering activities focused on projects involving Japan, the U.K., FRG, People's Republic of China (PRC), and France. Cooperation with Japan and the PRC in earthquake hazard mitigation is carried out, in part, under formal bilateral agreements.

Two fields dominate international engineering activities with the industrial countries. One is robotics and artificial intelligence work with Japan, the U.K., and France. The second is automated manufacturing research with institutions in the FRG, the U.K., and France. A small group of U.S. engineers met at Stuttgart in August, 1985 with their German counterparts to discuss the organizational and institutional issues surrounding manufacturing research. The volume entitled Manufacturing Research: Organizational and Institutional Issues, and consisting of the papers and proceedings was published in 1986 by Elsevier Science Publishers.

Considerable interest was expressed in the NSF Engineering Research Centers (ERC) program during the NSF Director's visit to France in June, 1985. The objective of this program is to stimulate academic research and education of more direct relevance to industry. Detailed discussions with the French about possible cooperation in the ERC program were opened in Washington in early FY 1986, and progress is being made on a program of collaboration. Other international engineering projects include studies of sediment transport mechanisms in rivers in Pakistan and the PRC, and remote sensing from space in cooperation with Egypt.

In view of the excellence of engineering abroad and the critical role U.S. engineers play in the nation's international competitiveness, greater attention was placed in FY 1986 on the international dimensions of engineering. The reorientation of the entire NSF engineering effort was initiated last year and continued in FY 1986 with redefinition of its roles and responsibilities with respect to international engineering. To meet its objectives, the NSF is developing a more focused, intensive program in international engineering. The elements are as follows:

1. Seeking knowledge and the distribution of knowledge generated in other countries. This function is accomplished in a variety of ways. Foreign scholars are invited to the U.S. to present state-of-the-art research papers on a specific subject of concern. The availability of journals that translate articles from languages not usually understood by people in the U.S. is publicized. Taking the leadership role in working with other agencies to collect and assess the state of technology in selected countries is another function. These countries typically are leaders in certain fields. NSF also commissions individuals or groups to prepare reports and document the status of engineering research and education in selected advanced countries. The identification of areas in engineering in which the U.S. leads also contributes to the dissemination of knowledge.

2. Sharing knowledge and knowledge-generating activities with all countries of the world. This category includes knowledge, wherever generated, that is not sensitive from the standpoint of security, economics, or defense and which should be available to the entire world because of its potential for improving safety and the human environment. It includes, for example, knowledge concerning mitigation of the effects of natural phenomena such as earthquake, wind, and flood; and knowledge of manmade hazards such as chemical and nuclear waste, and the reduction of acid rain. NSF plans to place greater emphasis on utilizing joint research, personnel, literature, laboratories, and field test facilities to obtain engineering data in its areas of interest.

3. Exploring cooperative research in fields where the free world will require collaboration to maintain its strength. This category includes communication, transportation, information technology, natural resource exploration, and industrial productivity.

4. Strengthening and improving ongoing international agreements. International activities already have been started under the auspices of the Economic Summit agreements in a variety of bilateral agreements involving earthquake research and remote sensing. The existing agreements and international program structures provide a good foundation for future programs.

Global or Regional Research Programs

It has become increasingly important to disciplines such as the earth, ocean, atmospheric, and polar sciences to study problems on a regional or global scale. These transnational sciences share a number of characteristics. First, the research frequently requires expensive facilities and complex logistical arrangements. Coordination between NSF and other federal agencies often is involved, and the support of U.S. scientists in projects organized under auspices of nongovernmental multilateral organizations, such as the International Council of Scientific Unions (ICSU) is essential. Second, several so-called less developed countries have advanced scientific capabilities in these fields. Third, the access issue is a significant factor, particularly in the earth, atmospheric, and ocean sciences where many nations have sought to widen their national jurisdiction to include space and coastal waters.

Subject to the principles of the Antarctic Treaty, scientific research serves as the principal expression of U.S. national policy and interest in the Antarctic region. NSF manages the U.S. Antarctic Program with participation by other federal agencies. The program provides many examples of bilateral and multilateral cooperation. The Ocean Drilling Program, with the U.S. component supported by NSF, also provides excellent examples of the mutual benefits that can be derived from scientific programs conducted as multilateral cooperative ventures.

NSF also is involved in a major new study of the continental lithosphere, and the planning of a new global seismic network.

Grants Under Bilateral Cooperative Science and Engineering Programs

NSF, over the last two decades, has become the executive or lead agency responsible for bilateral science agreements with foreign governments or counterpart organizations around the world. Overall, NSF administers 30 multidisciplinary formal agreements and 20 informal arrangements for bilateral scientific cooperation. NSF participates in important interagency activities such as the U.S.-India Initiative, is on the cutting edge of activities in S&T for development, and has established experience in relations with the USSR, China, and Eastern Europe. The NSF network of relations with industrial countries has been established firmly over the past five years.

The Division of International Programs (INT) within NSF is charged with specific responsibility for bilateral cooperation and coordination related to these activities in conjunction with the White House Office of Science and Technology Policy (OSTP) and the Department of State. INT also has responsibility for assessments of science and engineering strengths abroad, identifying opportunities in cost and resource sharing that can benefit U.S. science, and evaluation of international activities. These activities continued to expand in FY 1986 in response to directives from the National Science Board and NSF management. INT also provides an NSF focal point for liaison with multilateral organizations, an area strengthened significantly in FY 1986. INT supports U.S. adherence to the International Council of Scientific Unions (ICSU) through the National Academy of Sciences (NAS), and staffs advisory committees to NSF in international matters.

Illustrations of Bilateral Activities

Industrial Countries

Western Europe. Until 1979, NSF formal arrangements with Western Europe included the U.S.-Italy Cooperative Agreement established in 1968 and the U.S.-France Postdoctoral Exchange Program established in 1970. A 1977 NSF Advisory Council Task Force strongly recommended strengthening U.S. science by increasing cooperation with countries that have centers of scientific excellence. Beginning in 1978 the NSF concluded bilateral agreements with Switzerland, Belgium, the U.K., the FRG, Sweden, Finland, and Austria, and substantially restructured the U.S.-France Program. NSF has built a large and successful program of cooperation with Spain. In addition to providing support for activities under these formal arrangements, NSF also funds U.S. participation in projects under less formal arrangements with Denmark, Iceland, Ireland, the Netherlands, Norway, and The Vatican.

The U.S.-France Program provided the opportunity in 1986 for oceanographers at Oregon State University and the University of Pierre and Marie Curie in Paris to exchange data on organic matter alteration in hydrothermal vent environments, where unique and prolific ecosystems exist without photosynthetic link. Scientists at the University of Tennessee and the Research Institute of Physics (Atomfysik) at Stockholm studied collisions of highly charged ions with atoms and molecules under the U.S.-Sweden Program as well as the comparative effectiveness of synchrotron radiation vis-a-vis charged particle impact for the production of these ions. The U.S.-Austria Program supported a seminar in June, 1986 that brought together mathematicians from the U.S. and several European countries to assess recent progress in so-called inverse and ill-posed problems. Many of these problems occur in geophysics, molecular biology, remote sensing, computer tomography, and other areas. The seminar succeeded in developing cross-disciplinary communication, and in discussions between scientists at Cornell University and the University of Parma in Italy that led to a new iterative approximation that advances our understanding of the theory of the liquid state of matter. The investigators showed that within a class of problems the critical exponents that describe the liquid/vapor transitions are determined entirely by physical statements made in relation to a certain function (i.e., the bridge function), and additionally they provided a deeper insight into the classical inverse problem for distribution functions.

Japan. The cooperative science program with Japan began in 1961, and is the oldest NSF bilateral agreement. A wide range of cooperative research projects in scientific frontiers are supported. NSF and its Japanese counterparts including the Japan Society for the Promotion of Science, and the Ministry of Education, Science and Culture (MONBUSHO), facilitated a number of special activities in FY 1986. They included two in biotechnology, and one each in new materials and optoelectronics. A workshop on computer software engineering was planned for FY 1987. A new cooperative effort was the agreement between NSF and the Japanese Institute for New Generation Computer Technology (ICOT) to support U.S. scientists and engineers for the purpose of conducting joint NSF research at ICOT. This agreement was reached on the Director's initiative while visiting Japan in FY 1986, and has led to the NSF-ICOT Visitors Program in the NSF Directorate for Computer and Information Science and Engineering.

Postdoctoral and Sabbatical Exchanges. A Postdoctoral and Sabbatical Exchange Program was initiated in 1985 to assist U.S. scientists and engineers in visiting outstanding research institutions for about 12-month periods in industrialized country including those in Western Europe, Canada, Japan, Australia, and New Zealand. Thirty-four awards were made during the first year of the program. Among these, 15 are in the mathematical and physical sciences, two in the social sciences, and one each in materials research and computer sciences.

Developing Countries

U.S. scientists and engineers most often turn to Western Europe and Japan for partners. Several other countries, however, have made impressive strides in science and engineering, and as such are becoming increasingly attractive counterparts.

India. India has the world's third largest science and engineering community, and has developed world class capabilities in fields such as pure mathematics, statistics, nuclear physics, oceanography, and atmospheric science. The U.S.-India Presidential Science and Technology Initiative (STI) is intended to draw upon those capabilities for the mutual benefit of both countries. The NSF was designated by OSTP as U.S. Executive Agent for the initiative with responsibility for coordinating all program activities on a government-wide basis. General policy guidance is provided by the President's Science Advisor. A NAS panel, reporting to the Science Advisor, monitors the progress of cooperative programs, and makes recommendations about future activities. (Also refer to the Chapter 4 section on India.)

Brazil. The NSF-CNP_q bilateral program with Brazil, initiated in 1971, the most diversified of NSF Latin American programs, covers most fields of scientific specialization. Currently conducted under an agency-to-agency Memorandum of Understanding (MOU) signed by the Director of NSF in 1984 at Brasilia, the program has been funded during the 1980 at an average of about $350,000 per year.

An especially visible project is the on-going Projeto Flora Amazonica (i.e., the Brazilian Amazon Flora Project) to inventory rain forest species and determine ways to deal with fragile ecosystems threatened by urban and industrial development. Also, cooperation is encouraged by the program in a variety of areas in which Brazil has achieved scientific excellence. A leading example in the basic sciences is the work at the Institute for Pure and Applied Mathematics ranging through dynamic systems, topology, mathematical economics, complexity theory, and others.

The strongest area in physics is solid state research, but the University of Campinas (UNICAMP) also is a center of excellence in cosmic ray physics. Brazilian capabilities in the geosciences include stratigraphic analysis, geologic mapping, and metallogenesis; these areas are strong and complement U.S. interests. Other areas of relative strength are genetics, neurobiology, atmospheric physics, and macromolecular chemistry.

University-industry cooperation has been a major focus for discussion between the two countries for several years. A program for cooperative research between university-based innovation centers in both countries was initiated at Rio de Janeiro in July, 1985 through a workshop with Brazilian and U.S. industrial and engineering researchers; several projects have been funded under this program.

Other Developing Countries. Scientific opportunities are plentiful in other regions of the world as well. In the earth and biologic sciences and in the chemistry of natural products, sub-Sahara Africa provides one of the few remaining least-disturbed environments with the opportunity for considerable basic research to combat the health and hunger problems of this region. For example, schistosomiasis, a widespread infectious tropical disease, has proven extremely difficult to eradicate. The microorganism that causes the disease spends part of its life cycle in aquatic snails; recent research has concentrated on attacking the snail hosts, but there are few methods that are free of undesirable side-effects on man and other animals. This was the starting point for an international workshop held in Lusaka in cooperation with the Zambian National Council for Scientific Research on molluscicides.

NSF interactions with AID provide other opportunities. INT during FY 1986 continued to handle external review of AID research projects through organizing review panels under a Resource Support Services Agreement (RSAA). NSF also is working jointly with the Egyptian Academy of Scientific Research and Technology (ASRT) to develop cooperative scientific activities in a variety of highly important areas.

Communist Countries

People's Republic of China. The U.S.-PRC Protocol for Cooperation in the Basic Sciences was extended in April, 1986 for another five years. The signing formalities were held at Beijing in conjunction with the fifth meeting of the Joint Working Group in the Basic Sciences and the visit of the Director of NSF. The State Education Commission (SEDC) was added as a co-signatory to the Protocol Extension along with the Chinese

Academy of Sciences and the Chinese Academy of Social Sciences. The formal participation of SEDC will enhance American access to scientists, facilities, and the rapidly developing research programs at Chinese universities.

Overall, 102 primarily cooperative research projects in more than 50 subfields of the physical, biological, engineering and social sciences have been supported by the NSF U.S.-China Cooperative Science Program since 1980. The level of activity continues on an upward trend; proposal demand increased by 25 percent last year. Substantive, long-term, joint research has been stressed; and NSF has initiated projects in several new areas, particularly in engineering and materials science.

China's 1985 reforms in S&T management and funding already have produced a positive impact on cooperative science programs at NSF. The establishment of a National Natural Science Foundation of China (NSFC), closely modeled on the U.S. NSF, provides new opportunities for basic research in China and access to scientists regardless of their institutional affiliation. Another aspect of the reforms, China's emphasis on scientific and technological research for industrial and economic growth, matches U.S. interests. NSF supported cooperative projects during FY 1986 that focused on basic research connected to questions of the production of energy and the development of new engineering materials. One example is a cooperative research project between the ceramics research groups at the University of Michigan and the Shanghai Institute of Ceramics at the Chinese Academy of Sciences. The purpose of the research is to find superior ceramic materials capable of withstanding extremely high temperatures. Such materials eventually could be applied to use in car engines and turbines. Another example, involving the University of Tennessee and the Beijing Institute of Electrical Engineering at the Chinese Academy of Sciences, addresses the problem of fluctuations and instabilities that inhibit the efficient flow of energy in open-cycle power generators. Results from these experiments ultimately could be applied to the development of more energy-efficient generators of electricity.

Eastern Europe and Yugoslavia. The NSF cooperative science programs with selected countries of Eastern Europe and with Yugoslavia enhance U.S. science and engineering, and advance U.S. foreign policy objectives. Nongovernmental channels for science and engineering contacts also are maintained with the USSR, Eastern Europe, and Yugoslavia through support of the exchange programs of NAS.

NSF continues to stress long-term cooperative research projects with Hungary, bilateral seminars in fields of special mutual interest with Romania, and a modest level of cooperative research activity with Bulgaria. In Yugoslavia, NSF cooperates in long-term research projects under the program of the U.S.-Yugoslavia Joint Board on Scientific and Technological Cooperation. NSF also has been working toward establishment of formal cooperative programs with Czechoslovakia and the Democratic Republic of Germany (GDR), subject to U.S. foreign policy guidelines. Progress has been greatest with Czechoslovakia, where negotiations are expected to yield an MOU early in 1987. The question of reestablishing formal NSF cooperative ties with Poland is currently being examined. A modest level of scientific contact continues through nongovernmental channels.

Scientific benefits derived from these programs continue to be high. A cooperative physics project on "Quantum Flavor Dynamics" between scientists of Purdue University and the University of Zagreb, sponsored by the NSF through the program of the U.S.-Yugoslavia Joint Board, has played a significant role in the development of an important new theory about the existence of a fifth force of nature. Based in part on anomalies observed during a 1909 gravity-measuring experiment by the Hungarian physicist Lorand Eotovos, the U.S.-Yugoslav team found evidence that there is a new fifth force called the "hypercharged force" that acts at short distances against gravity. This work has stimulated widespread experimental work at laboratories in the U.S. and elsewhere to test the new theory.

NSF supported cooperative research during FY 1986 with Hungary that should yield engineering advances in the use of biomass for chemicals and energy. The joint efforts of the University of Hawaii and the Hungarian Research Laboratory for Inorganic Chemistry, Budapest, involve using state-of-the-art thermal analysis instrumentation and sophisticated numerical methods for interpreting data gathered in solid phase pyrolysis of biopolymer materials. The materials studied include sugarcane bagasse and corn straw. Results are expected to improve the ability to manipulate biomass conversions and produce a more valuable slate for products from pyrolytic reactors.

Funding

The Division of International Programs in NSF had a budget of approximately $10.2 million for international cooperative S&T programs during FY 1986. It is difficult to put an exact figure on the total funding for international research as about 20 percent of the 12,000 grants awarded by NSF during FY 1986 to American scientists, engineers, and mathematicians included international components.

APPENDIXES

Acronyms for Appendixes I and II

Departments and Agencies

USDA - Department of Agriculture
  ARS - Agricultural Research Service
DOC - Department of Commerce
  NBS - National Bureau of Standards
  NOAA - National Oceanographic & Atmospheric Administration
  NTIA - National Telecommunications & Information Administration

ED - Department of Education
  NIHR - National Institute for Handicapped Research

DOE - Department of Energy

DHHS - Department of Health and Human Services
  PHS - Public Health Service
  OASH - Office of the Assistant Secretary for Health
  CDC - Centers for Disease Control
  FDA - Food and Drug Administration
  HRSA - Health Resources and Services Administration
  NIH - National Institutes of Health
  ADAMHA - Alcohol, Drug Abuse, & Mental Health Administration

DOI - Department of the Interior
  BOM - Bureau of Mines
  BOR - Bureau of Reclamation
  USGS - U.S. Geological Survey
  FWS - Fish and Wildlife Service
  OSM - Office of Surface Mining

DOT - Department of Transportation

AID - Agency for International Development

EPA - Environmental Protection Agency

NASA - National Aeronautics and Space Administration

NRC - Nuclear Regulatory Commission

NSF - National Science Foundation

Other Acronyms:
  CRSP- Collaborative Research Support Program

APPENDIX I

Table of Science and Technology Activities of U.S. Government Agencies by Country FY 1986

Countries	Umbrella S&T Agree- ments	Active Agencies											
		USDA	DOC	ED	DOE	DHHS	DOI	DOT	AID	EPA	NASA	NRC	NSF
Algeria		X											
Argentina	X	X	X										X
Australia	X	X	X			X	X	X			X		X
Austria						X							X
Bangladesh							X		X				
Belgium					X	X						X	X
Benin									X				
Bolivia			X				X		X				
Botswana							X		X				
Brazil	X	X	X		X	X	X	X	X			X	X
Bulgaria		X											X
Burkina Faso									X				
Burma									X				
Burundi									X				
Cameroon									X				
Canada		X	X		X	X	X	X		X	X	X	
Central African Rep.									X				
Chad									X				
Chile		X	X				X		X		X		
China(PRC)	X	X	X		X	X	X	X	X	X	X	X	X
Colombia			X				X		X				
Costa Rica		X					X		X				
Denmark						X						X	
Dominica									X				
Dominican Republic			X				X		X				

Countries	Umbrella S&T Agreements	Active Agencies											
		USDA	DOC	ED	DOE	DHHS	DOI	DOT	AID	EPA	NASA	NRC	NSF
Ecuador			X						X				
Egypt	X	X	X	X	X	X	X		X	X		X	X
El Salvador							X		X				
Finland	X					X		X				X	X
France		X	X		X	X	X	X		X	X	X	X
Gabon					X								
Germany(FRG)		X	X		X	X	X	X		X	X	X	X
Ghana									X				
Greece		X										X	
Grenada									X				
Guatemala		X					X		X				
Haiti		X							X				
Honduras							X		X				
Hungary		X				X	X	X					X
Iceland						X	X						
India	X	X	X	X	X	X	X	X	X	X	X		X
Indonesia	X	X	X				X		X		X		
Iraq									X				
Ireland						X							
Israel	X	X			X	X	X	X				X	X
Italy	X	X			X	X	X	X			X	X	X
Ivory Coast							X	X	X				
Jamaica						X			X				
Japan	X	X	X		X	X	X	X		X	X	X	X
Jordan							X		X				
Kenya	X	X							X				
Korea	X	X	X		X	X	X		X			X	X
Kuwait						X	X						X
Lesotho									X				

APPENDIX I (continued)

Countries	Umbrella S&T Agreements	Active Agencies											
		USDA	DOC	ED	DOE	DHHS	DOI	DOT	AID	EPA	NASA	NRC	NSF
Liberia							X	X	X				
Luxembourg								X					
Madagascar									X				
Malawi									X				
Malaysia									X				
Mali									X				
Mauritius									X				
Mexico	X	X	X		X	X	X	X	X	X	X	X	X
Morocco							X		X				
Mozambique							X	X					
Nepal									X				
Netherlands		X			X	X		X		X	X	X	
New Zealand	X	X				X	X						X
Niger									X				
Nigeria						X			X				
Norway						X							
Pakistan	X	X	X			X	X		X				X
Panama			X				X		X				
Papua New Guinea							X		X				
Peru		X	X				X		X				
Philippines		X					X		X			X	
Poland		X				X	X	X					
Portugal		X				X	X						
Romania		X				X		X					X
Rwanda									X				
St. Lucia									X				

APPENDIX I (continued)

Countries	Umbrella S&T Agreements	USDA	DOC	ED	DOE	DHHS	DOI	DOT	AID	EPA	NASA	NRC	NSF
		Active Agencies											
Saudi Arabia			X		X	X	X	X			X		X
Senegal	X						X	X	X		X		
Sierra Leone									X				
Somalia									X				
South Africa			X										
Spain		X	X		X	X	X	X			X	X	X
Sri Lanka	X								X				
Sudan		X							X				
Swaziland									X				
Sweden				X	X	X				X		X	X
Switzerland					X	X						X	X
Syria									X				
Tanzania									X				
Thailand	X	X	X			X			X				
Togo									X				
Tunisia						X			X				
Turkey	X	X					X	X	X				X
Uganda									X				
United Kingdom			X		X	X	X	X			X	X	X
USSR		X	X		X	X	X	X		X			
Venezuela	X	X			X	X	X	X	X				
Yemen Arab Republic									X				
Yugoslavia	X	X	X	X		X	X	X		X		X	X
Zaire									X				
Zambia									X				
Zimbabwe		X				X			X				

APPENDIX II

Descriptive Listing of Activities by Country under Bilateral Science and Technology Agreements

FY-1986

Algeria

USDA	Agricultural research and development

Argentina

USDA	Agriculture, livestock and forestry
USDA/ARS	Biological Control of Weeds Laboratory
DOC/NOAA	Landsat ground station; GOES data collection system
NSF	Exchange of information and scientists, biology, establishment and operation of S&T installations in physics and astronomy (Halley's Comet observations)

Australia

USDA	Agricultural research and development
DOC/NOAA	Landsat ground station
DHHS/FDA	Consumer protection and regulation
DOI/BOM	Fire and explosion prevention, methane removal
DOT	Under U.S.-Australian S&T Agreement: policy, specialist and research exchanges, on variety of subjects.
NASA	Launch of Aussat communications satellites
NSF	Biotechnology, health related research, material sciences, chemical oceanography

Austria

DHHS/NIH	Health cooperation, exchange of information
NSF	Exchange of information and scientists, basic and applied research, education

Bangladesh

AID	Family planning services, primary health care
DOI/USGS	Accelerated exploration of mineral resources and modernization of Geological Survey (funded by Asian Development Bank)

Belgium

DHHS/FDA	Consumer protection and regulation
DHHS/NIH	Biomedical research
NRC	Severe accident research, thermal hydraulic research information exchange
DOE	Radioactive waste management
DOT	Informal exchanges on variety of modal areas
NSF	Biophysics, materials research, metallurgy

Benin

AID	Family planning development

Bolivia

AID	Health operations research, primary health care, family planning, water and sanitation
DOI/USGS	Earth sciences, global seismic data acquisition system
DOC/NOAA	GOES data collection system

Botswana

AID	Nutrition surveys, appropriate technology
DOI/USGS	Global Seismography Network

Brazil

USDA	Scientific & technical cooperation in agriculture
USDA/ARS	Fire ant research
AID	Family planning program development, family planning services
DOC/NOAA	Landsat ground station; GOES data collection system
DHHS/NIH	Infectious and tropical diseases
DOI/USGS	Geological sciences, earth resources for minerals and energy, global seismic network
DOI/BOM	Mining techniques, mineral technology and economics, environmental studies, evaluation of mineral deposits
NRC	Information exchange
DOT	Urban mass transportation, fuel conservation
DOE	Underground coal gasification technology
NSF	Ecology, applied mathematics, geology, university-industry cooperation

Bulgaria

USDA	Agriculture
NSF	Chemical, thermal and biochemical engineering; space sciences

Burkina Faso

AID	Water and sanitation systems, population program development

Burma

AID	Demographic data collection, primary health care

Burundi

AID	Population program development

Cameroon

AID	Family planning services, appropriate technology, primary health care

Canada

USDA	Cooperative research in areas of mutual interest
DOC/NOAA	Landsat ground station and North America vertical datum adjustment; GOES data collection system; Satellite-Aided Distress Alert & Location Agreement (COSPAS/SARSAT)
EPA	R&D cooperation, Great Lakes water quality, discharge of pollutants along inland boundary
DHHS/FDA	Consumer protection and regulation
DHHS/NIH	Biomedical research
DOI/USGS	Geological and remote sensing sciences, Great Lakes seismic reflection profiles, deep ocean sulfide mineral deposit studies, water quality data, mapping science studies
DOI/BOM	Diesel engine emissions, mine acid drainage wire ropes, rockburst prediction, radiation hazards, mineral and materials research
NASA	Development of remote manipulator system, launch of Telesat communications satellites, flight of Payload Specialists on the Shuttle, definition and design studies of Space Station
NRC	Severe accident research
DOT	Civil aviation, conventional rail, marine, urban, highway/traffic safety, hazardous materials transport

DOE	Radioactive waste management, research and development of tar sands, information exchange, systems analysis of heavy-water power reactors

Central African Republic

AID	Population program development

Chile

USDA	Agriculture research and development
AID	Population program development
DOC/NOAA	Tsunami hazard reduction (AID contract), ocean climate studies
DOI/USGS	Earth sciences, mineral resources studies
NASA	Emergency landing site for Shuttle and S&T cooperation

China (PRC)

USDA	Agricultural research and development
DOC/NBS	Metrology and standardization
DOC/NOAA	Marine and fishing research, atmospheric S&T, geophysical studies, Landsat ground station
DOC/NTIA	Telecommunications science and technology
DHHS/PHS	Public health, biomedical research, mental health, foods and drugs, disease control, health information systems
DHHS/FDA	Consumer protection and regulation
DHHS/NIH	Basic biomedical sciences and research
DOI/USGS	Scientific and technical cooperation in earthquake studies, earth sciences, surface water hydrology, surveying and mapping studies
DOI/BOR	Technical consulting services on Three Gorges Dam
NRC	Information exchange
DOT	Highway, aviation, urban, rail, port engineering, and transport planning
DOE	Cooperation in energy research, fossil energy research and development
EPA	Lung cancer/coal combustion study, air sampling, chemical and toxicological analysis, acid deposition
NSF	Exchange of scientists, training, basic sciences, earthquake studies, earth sciences

Colombia

AID	Population program development, family planning services, appropriate technology
DOC/NOAA	Meteorology
DOI/USGS	Earth sciences, volcanic eruption disaster assistance

Costa Rica

USDA	Agricultural research
AID	Forest resources management, energy resource development, appropriate technology
DOI/USGS	Mineral and geothermal energy resources (AID/LANL)

Denmark

DHHS/FDA	Consumer protection and regulation
NRC	Information exchange

Dominica

AID	Health operations research

Dominican Republic

AID	Agriculture program development, appropriate technology, nutrition program development, health operations research, population program development
DOC/NOAA	GOES data collection system
DCI/USGS	Geological sciences

Ecuador

AID	Primary health care, nutrition program, family planning services, forest resources program development
DOC/NOAA	Oceanographic and atmospheric phenomena

Egypt

USDA	Agricultural research and technology
AID	Family planning services, irrigation activities, population program development, malnutrition studies
DOC/NBS	Metrology and standarization
ED/NIHR	Rehabilitation R&D

EPA	Environmental hazards
DHHS/PHS	Biomedical research, health services improvement, health statistics, drugs and biologicals, health manpower development, medical education
DOI/FWS	Technical assistance in wildlife management, research, endangered species surveys, conservation education
DOI/BOR	Automated hydrologic data collection system
NRC	Information exchange
DOE	Radioactive waste management
NSF	Remote sensing

El Salvador

AID	Demographic and health surveys
DOI/USGS	Earthquake research

Finland

DHHS/PHS	Occupational safety and health, alcoholism, development and testing of vaccines, health services research
DHHS/FDA	Consumer protection and regulation
NRC	Thermal-hydraulic and materials research, information exchange
DOT	Icebreaking, traffic safety, highway planning
NSF	Biology, ecology, astronomy

France

USDA	Agricultural science and technology
USDA/ARS	European Parasite Laboratory
DOC/NBS	Computer S&T, metrology, materials research, building technology
DOC/NOAA	Science program in oceanography, Tiros-N weather satellite data collection system, Satellite-Aided Distress Alert & Location Agreement (COSPAS/SARSAT)
EPA	Hazardous waste, wastewater, sludge, diesel particles, aerosols
DHHS/NIH	Biomedical research, health sciences
DHHS/FDA	Consumer protection and regulation

DHHS/OASH	Health care utilization, medical facility utilization
DOI/USGS	Geological sciences; sea-ice studies; radioactive waste disposal studies; geophysical and geochemical techniques;
DOI/BOM	Mineralogy and ore dressing technology, mineral resource data
NASA	Flight of Payload Specialist on Shuttle, emergency landing site for the Shuttle in the Pacific
NRC	Heat removal by natural convection, steam generator safety research, radiation effects on polymers, fast breeder reactor safety research, thermal hydraulic research, radioactive waste management, light water reactor safety research and developments, pressure testing of concrete container model, information exchange
DOT	Marine, advanced urban systems, rail, civil aviation, highway construction
DOE	Radioactive waste management, technology concepts for gas cooled and fast breeder reactor safety
NSF	Engineering, computational mathematics, social sciences

Gabon

DOE	Evaluation of photovoltaic power systems in four villages

Germany (FRG)

USDA	Agricultural science and technology
DOC/NOAA	Geophysical studies
EPA	Solid and hazardous waste, air quality, toxic substances, radiation, acid deposition research, environmental management, specimen bank, environmental impact analysis
DHHS/PHS	Biomedical research, health sciences, health information
DOI/USGS	Geological sciences
DOI/BOM	Mineral data bank, submicron data analyzer, concentration sensor

NASA	Flight of German Shuttle Pallet satellite, flight of the D-1 microgravity Spacelab mission including three European Payload Specialists on the Shuttle, active magnetospheric Particle Tracer Explorers project, the Galileo mission to Jupiter, Rosat x-ray survey satellite mission
NRC	Loss of coolant flow in pressurized water reactors, fast breeder reactor performance, severe accident research, safety research for superheated reactor, thermal-hydraulic research, general light water reactor safety research and development, reactor pressure vessel testing research information exchange
DOT	Rail, highway, urban systems and equipment, socio-economic studies
DOE	Radioactive waste management, conversion of methanol to gasoline/olefins in a fluidized bed system, fast breeder reactor, safeguards and physical security
NSF	Robotics, manufacturing sciences, chemistry, polymer sciences

Greece

USDA/ARS	Biological Control of Weeds Laboratory (Worksite at Thessaloniki)
NRC	Information exchange

Grenada

AID	Agriculture pest control, health operations research

Guatemala

USDA/ARS	Research on Mediterranean fruit fly
AID	Nutrition services development, primary health care, population/family planning services
DOI/USGS	Minerals, energy, water resources, geologic hazards, zonification, seismic risk (AID contract)

Haiti

USDA	Agricultural research
AID	Mass media health practices, forestry and natural resources development, family planning services, nutrition program development

Honduras

AID	Fish farming; nutrition program development; mass media/health practices; family planning program development; family planning services; energy, forest and environmental program development; primary health care
DOI/USGS	Geothermal energy resources (AID/LANL)

Hungary

USDA	Agricultural trade and cooperation
DHHS/NIH	Biomedical research and exchanges with emphasis on cancer
DOI/USGS	Geology, geophysics projects, petroleum assessment of Pannonian Basin
DOT	Rail/bridge design and construction, traffic planning, highway/rail crossing safety
NSF	Physics, biology, regional geography, manufacturing research

Iceland

DHHS/FDA	Consumer protection and regulation
DOI/USGS	Earth sciences, glacial studies, volcano studies

India

USDA	Agricultural research and technology
AID	Irrigation, soil management, population program development, family planning health operations research, energy program development
DOC/NBS	Materials science
DOC/NOAA	Monsoon research program, S&T initiative, ocean sciences and terrestrial physics, Landsat ground station
ED/NIHR	Rehabilitation research and development
EPA	Environmental projects
DHHS/PHS	Health and biomedical sciences, infectious diseases, vaccine development, prevention of blindness, mental health, reproductive physiology, health information
DOI/FWS	Endangered species survey and conservation

DOI/OSM	Land reclamation, mine land use planning technology, mining impacts on surface hydrology
NASA	Launch of Insat communications satellites, flight of Payload Specialist on the Shuttle
DOE	Coal and biomass conversion (AID contract)
NSF	Guest scientists, monsoon research, material sciences, astronomy

Indonesia

AID	Primary health care; nutrition improvement; fish farming; family planning services; appropriate technology; energy, environment, and natural resources development
DOI/USGS	Volcano monitoring and research (AID contract); marine geology and geophysics project; peat resources pilot study; clay mineral chemistry and volcanology consultancies (ADB)
NASA	Launch of Palapa communications satellites, flight of Payload Specialist on the Shuttle

Iraq

AID	International Agriculture Research Center

Ireland

DHHS/NIH	Cooperation in biomedical research

Israel

USDA	Binational Agriculture Research and Development Fund (BARD)
DHHS/PHS	Health services research information and policy issues, food and drug consumer protection, biomedical research
DHHS/ADAMHA	Alcohol abuse and alcoholism
DOI/USGS	Global seismograph network, phosphate research
NRC	Information exchange
DOT	Highway and traffic safety, travel behavior, urban transport planning
DOE	Energy research and development, information and personnel exchange, extracting oil from shale, low-temperature/low-pressure coal conversion
NSF	Cooperative research projects, exchange of scientists

Italy

USDA/ARA	Biological Control of Weeds Laboratory
DHHS/PHS	Cancer, heart disease, drug abuse, biomedical research
DOI/USGS	Earthquake station reconstruction program, seismic-volcanic monitoring (AID contract), earth sciences, seismic studies
NASA	Development and flight of the Tethered Satellite System, the Lageos-2 satellite project, flight of Payload Specialist on Shuttle
NRC	Loss of coolant calculations, severe accident research, thermal hydraulic research information exchange
DOT	Civil aviation, highway traffic safety, emergency transportation, urban transport, and transport planning
DOE	Fossil fuels research and development
NSF	Exchange of information and scientists, robotics, biology, physics, social sciences

Ivory Coast

DOI/USGS	Global telemetered seismograph network
AID	Population program development

Jamaica

AID	Energy and environmental program development, health program development
DHHS/OASH	Vital statistics and health information

Japan

USDA	Agricultural research
DOC/NBS	Fire research, wind and seismic effects, telecommunications
DOC/NOAA	Marine activities, geophysical studies, Landsat ground station
EPA	Water, air, solid waste, toxic substances, epidemiology
DHHS/NIH	Cooperation on major health problems of Asian countries, exchanges and vision research, exchanges and cancer research, problems of the aging, cooperation on indexing for biomedical information systems, cooperation on laboratory animal models, recombinant DNA, vaccine development, cardiovascular disease, toxicology

DHHS/ADAMHA	Alcoholism and mental health
DHHS/FDA	Consumer protection and regulation
DHHS/OASH	Health statistics
DOI/USGS	Geological sciences
DOI/FWS	Exchange of information, provision of technical assistance for research and restoration of endangered species
NASA	Definition and design studies of Space Station, emergency landing site for the Shuttle, flight of the Spacelab-J microgravity mission and Payload Specialist on the Shuttle
NRC	Research reactor performance calculations, loss of coolant flow in fast breeder reactors, severe accident research, containment analysis, assessments on partial loss of coolant, radioactive waste management, information exchange
DOT	High speed rail, aviation, urban mass transportation management/systems
DOE	Radioactive waste management, fusion, high energy physics, large superconducting magnets, long-term effects of radiation exposure, research and development in energy
NSF	Earthquake engineering, biotechnology, material sciences, computer software, opto-electronics, photoconversion, photosynthesis

Jordan

AID	Soil management, conventional energy, family planning services
DOI/USGS	Earth sciences, seismic systems

Kenya

USDA/ARS	Foreign animal disease laboratory
AID	Appropriate technology

Korea

USDA/ARS	Asian Parasite Laboratory
AID	International Agriculture Research Center
DOC/NBS	Standards research, construction technology

DHHS/FDA	Consumer protection and regulation
DOI/USGS	Earth sciences; offshore petroleum resources assessment; sedimentary basin analysis for mineral and hydrocarbon resources
DOI/BOM	Mine ventilation, mine acid drainage, mineral technology, mineral data analysis
NRC	Severe accident research, thermal hydraulic research, information exchange
DOE	Energy conservation research, radioactive waste management, exchange of coal-related information and staff
NSF	Physics and applications of semi-conductor materials, transportation planning models and the environment, marine geology and physical processes of the Yellow Sea, R&D management, forest diseases & insect pests

Kuwait

DHHS/PHS	Reimbursable cooperation in agreed areas
DOI/USGS	Earth sciences, sand and gravel resources
NSF	Scientific exchanges, biosaline research

Lesotho

AID	Nutrition surveys, mass media/health practices

Liberia

AID	Energy program development, health operations research
DOI/USGS	Mineral resources program development

Madagascar

AID	Agriculture program development, energy program development

Malawi

AID	Mass media/health practices

Malaysia

AID	Population program development

Mali

AID	Forestry/fuelwood research and development, pest control, population program development, appropriate technology

Mauritius

AID	Family planning services

Mexico

USDA	Agricultural research and development, including activities related to plant genetic resources
USDA/ARS	Screwworm research
AID	Nutrition program, population program development, family planning services
DOC/NOAA	Ocean, earth, atmospheric and space sciences
EPA	Environmental programs, Tijuana sanitation, contingency planning for inland border spills
DHHS/PHS	Cooperation in agreed areas of health research and on border health problems
DHHS/FDA	Consumer protection and regulation
DHHS/ADAMHA	Alcohol related problems
DHHS/NIH	Biomedical research, medical equipment maintenance
NASA	Launch of the Morelos communications satellites, flight of Payload Specialist on Shuttle
NRC	Information exchange
DOT	Rail, highway, marine (search/rescue and environment), and joint border transport planning
DOE	Radioactive waste management, petroleum research and development, preparation of electrocatalysts for fuel cells
NSF	Earthquake engineering, geology, marine sciences, physics

Morocco

AID	Primary health care, irrigation, population/family planning, energy program development
DOI/USGS	Structure of earth's crust and metallic ores (AID contract), earth sciences; remote sensing

Mozambique

DOI/USGS	Earth sciences

Nepal

AID	Irrigation activities, appropriate technology, forestry and natural resources development, primary health care, health care services

Netherlands

USDA/ARS	Market quality research facility
USDA	Agricultural science and technology
DHHS/FDA	Consumer protection and regulation
DHHS/NIH	Biomedical research
NASA	Infrared Astronomical Satellite project
NRC	Severe accident research, information exchange
DOT	Marine, urban and transport economics, traffic safety
DOE	Magnetohydrodynamic research
EPA	Environmental management, hazardous waste management and emergency preparedness, water-quality protection, health effects, acid deposition

New Zealand

USDA	Agricultural research and development
DHHS/FDA	Consumer protection and regulation
NSF	Oceanography, earth sciences, geotechnical engineering

Niger

AID	Agriculture program development, population program development, irrigation

Nigeria

AID	Nutrition services, primary health care, population program development, family planning services
HHS/PHS	Health education, health information systems, occupational health, communicable diseases, food and drug regulation

Norway

DHHS/FDA	Consumer protection and regulation
DHHS/OASH	Infant and perinatal health information
DHHS/NIH	Biomedical research

Pakistan

USDA	Agriculture research
AID	Family planning services, energy resources development, primary health care
DOI/USGS	Earthquake hazards mitigation program (AID contract)
DOC/NBS	Physical standards research
DOC/NOAA	Landsat ground station
DHHS/PHS	Health sciences and health information
DOI/USGS	Energy planning and development project, coal resource assessment (AID contract)
DOI/FWS	Exchange of information, training and research projects on wildlife, endangered species
NSF	Biotechnology, oceanography, development of S&T manpower

Panama

AID	Nutrition services, biotechnology
DOC/NOAA	GOES data collection system

Papua New Guinea

AID	Malaria research
DOI/USGS	Mineral resources assessment

Peru

USDA	Agricultural research
AID	Nutrition services, mass media/health practices, pest control
DOC/NOAA	Ocean climate studies, development of facility to make ozone and related atmospheric measurements
DOI/USGS	Earth sciences, mineral resources

Philippines

USDA	Agricultural science and technology
AID	Energy environment and natural resources, primary health care, population program development, family planning services, appropriate technology
NRC	Thermal-hydraulic research, information exchange

Poland

USDA	Agricultural research and technology
DHHS/PHS	Biomedical and health sciences, health services utilization, mental health
DOI/BOM	Coal mine health and safety technology
DOT	Conventional rail, highway construction, traffic safety

Portugal

USDA	Agriculture research
DHHS/HRSA	Emergency medical services
DHHS/OASH	Vital and health statistics

Romania

USDA	Agricultural cooperation
DHHS/PHS	Exchanges of health professionals and other agreed activities
DHHS/NIH	Cancer research
DOT	Highway construction, conventional rail, energy conservation in marine areas
NSF	Civil engineering, mathematical physics

Rwanda

AID	Population program development

St. Lucia

AID	Family planning services

Saudi Arabia

USDA	Regional agriculture and water research center
DOC/NOAA	Landsat ground station
DHHS/FDA	Consumer protection and regulation
DHHS/HRSA	Emergency medical services
DOI/USGS	Geology and geophysics institution building, publications assistance, technical assistance in hydrology
NASA	Space and space-related science and technology, flight of Payload Specialist on Shuttle

DOE	Evaluation of photovoltaic power systems in three villages, solar energy water desalination, research and development of solar/photovoltaic systems
DOT	Highway planning, design, construction and maintenance, railroad operations
NSF	Collaborative projects, S&T assistance to build infrastructure

Senegal

AID	Population program development, soil management
DOI/USGS	Ground water monitoring (AID contract)
NASA	Emergency landing site for Shuttle

Sierra Leone

AID	Family planning program development

Somalia

AID	Energy program development, primary health care, family planning program development

South Africa

DOC/NOAA	Landsat ground station

Spain

USDA	Research workshops
DHHS/PHS	Health sciences
DOI/USGS	Earth sciences, water resources, marine geology, remote sensing
NASA	Emergency landing site for Shuttle and S&T cooperation
NRC	Severe accident research, nuclear plant analyzer, thermal hydraulic research information exchange
DOT	Transport planning, rail operations
DOE	Energy technology
NSF	Biological sciences, biochemistry, engineering, materials research

Sri Lanka

AID	Appropriate technology; primary health care; family planning services; energy, environment, and natural resources development

Sudan

USDA	Agricultural research
AID	Population program development, family planing services,

Swaziland

AID	Mass media/health practices

Sweden

ED/NIHR	Rehabilitation R&D
DHHS/FDA	Consumer protection and regulation
DHHS/OASH	Infant and perinatal health data
DHHS/NIH	Biomedical research
EPA	Acid deposition effects, hazardous waste management, toxic chemical regulation
NRC	Thermal-hydraulic research, Marviken Project severe accident research, general reactor safety research information exchange
DOE	Radioactive waste management
DOT	Informal exchanges, primarily on highway/traffic safety and urban highway systems
NSF	Mathematics, astronomy, physics, biology, engineering

Switzerland

DHHS/FDA	Consumer protection and regulation
DHHS/NIH	Exchanges in the biomedical sciences
NRC	Thermal-hydraulic and emergency cooling capabilities, materials properties, fracture mechanics, radioactive waste management safety information exchange
DOE	Radioactive waste management
DOT	Informal exchanges, primarily in highway construction
NSF	Scientific exchanges, physical sciences, engineering

Syria

AID	International Agriculture Research Center

Tanzania

AID	Appropriate technology

Thailand

USDA	Agricultural development
AID	Appropriate technology, irrigation, fossil fuel/conventional energy system, malaria immunity and vaccination, primary health care, family planning services
DOC/NOAA	Landsat ground station
DHHS/NIH	Biomedical sciences

Togo

AID	Family planning program development

Tunisia

AID	Family planning services, primary health care, International Agriculture Research Center
DHHS/HRSA	Health services
DHHS/NIH	Biomedical research
DHHS/OASH	Information exchange

Turkey

USDA	Scientific and technological cooperation in agriculture
AID	Population program development, family planning services, primary health care
DOI/USGS	Global seismic program
NSF	Earthquake engineering, seismology

Uganda

AID	Family planing services

United Kingdom

DOC/NOAA	Stratospheric sounding unit use
DHHS/FDA	Consumer protection and regulation
DHHS/OASH	Collaborative research on infant and perinatal health information
DHHS/NIH	Biomedical sciences
DOI/USGS	Earth resources and marine geophysical and environmental studies

DOI/BOM	Mine monitoring, water assisted mechanical cutting, drill guidance
NASA	Infrared Astronomical Satellite, active magnetospheric particle tracer explorers, Rosat X-ray survey mission, launch of Skynet satellites, flight of Payload Specialist on Shuttle
NRC	Modelling of coolant loss, general light water reactor safety research and development, severe accident research pressure testing of concrete containment model, information exchange
DOT	Highway and traffic safety, aviation, rail, urban systems, equipment and policies, economic studies on transport
DOE	Energy research and development, exchange of personnel in nuclear energy field, pressurized fluidized bed combustion, fast breeder reactor
NSF	Automated manufacturing, robotics, artificial intelligence

USSR

USDA	Agricultural cooperation
DOC/NBS	Physical sciences
DOC/NOAA	Oceanographic research and technology, climate modelling; Satellite-Aided Distress Alert & Location Agreement (COSPAS/SARSAT)
EPA	Air, water, agriculture, and marine pollution, urban environment, nature conservation, biological/genetic effects, climatic effects, earthquake prediction, environmental law and policy
DHHS/PHS	Cooperation and professional exchanges in biomedical sciences and public health
DHHS/NIH	Artificial heart R&D, environmental research (EPA Agreement)
DOI/USGS	Global seismic program
DOE	Exchange of personnel and information in fusion, fast breeder reactors, fundamental properties of matter

Venezuela

AID	Health program development
USDA	Agricultural cooperation
DHHS/PHS	Biomedical research and health services
DOI/USGS	Earth sciences, assessing hydrology and water resources of the Orinoco Basin

DOE	Energy research and development, characterization of heavy crude information, personnel exchange, enhanced oil recovery, coal preparation and combustion

Yemen Arab Republic

AID	Primary health care

Yugoslavia

USDA	Agricultural research and technology
DOC/NBS	Spectroscopy, materials research, earthquake resistant buildings
ED/NIHR	Rehabilitation R&D (SFC, competitive dollar grant)
EPA	Environmental research
DHHS/PHS	Research in collaborative biomedical sciences
DOI/BOM	Longwall mining of thick and steep coalbeds, respirable dust control, mined land reclamation, subsidence, coal mine electrotechnology, health and safety in mercury mines
DOI/USGS	Soil condition and structure; seismology and earthquake hazards; geochemical surveys; granite metamorphic complexes; groundwater modeling; coal resources; mineral nitrogen in ground water, soil and plants; agrohydrology
NRC	Information exchange
DOT	Highway construction studies on pavement materials and soft soils, earthquake stability research on transport systems
NSF	Chemistry, physics, chemical and civil engineering, biology, robotics

Zaire

AID	Nutrition services, energy program development, health operations research, family planning services, appropriate technology

Zambia

AID	Nutrition program development, family planning services

Zimbabwe

USDA	Agricultural science and technology
AID	Family planning services
DHHS/PHS	Health sciences

Appendix III

U.S. Contributions to Selected International Organizations - FY 1986

Organization	Assessed or Pledged	Contributed
	(in $ millions)	
Food and Agriculture Organization	55.7	36.8
International Atomic Energy Agency (Regular Budget)	22.6	19.1
IAEA Operational	7.2	7.0
IAEA Safegaurds	6.6	6.0
International Civil Aviation Organization	7.6	7.4
International Maritime Organization	0.5	0.5
International Telecommunication Union	3.3	3.3
NATO Science Committee	3.7	3.7
Organization for Economic Cooperation and Development	22.2	20.4
World Health Organization	65.3	58.6
WHO Voluntary Contribution	8.8	8.8
PanAmerican Health Organization	37.8	25.6
PAHO Voluntary Contribution	3.0	3.0
World Meteorological Organization	4.7	4.6
WMO/Voluntary Contributions Program	1.6	1.4

CONGRESSIONAL RESEARCH SERVICE COMMENTS ON THE 1987 TITLE V REPORT, THE EIGHTH ANNUAL REPORT, FOR 1986, SUBMITTED TO THE CONGRESS BY THE PRESIDENT PURSUANT TO SECTION 503 (b) OF TITLE V OF PUBLIC LAW 95-426

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August 18, 1987

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CONGRESSIONAL RESEARCH SERVICE COMMENTS ON THE 1987 TITLE V REPORT, THE EIGHTH ANNUAL REPORT, FOR 1986, SUBMITTED TO THE CONGRESS BY THE PRESIDENT PURSUANT TO SECTION 503 (b) OF TITLE V OF PUBLIC LAW 95-426[1]

The report entitled "Science, Technology, and American Diplomacy, 1987, covering activities during 1986," is the eighth annual report that has been prepared since 1980 pursuant to Title V, "Science, Technology, and American Diplomacy," of P.L. 95-426. The report, which was transmitted to the Congress on June 17, 1987 and which contains 230 pages, was prepared by staff of the Department of State in cooperation with an interagency team. It was accompanied by a Presidential message. This is the seventh Congressional Research Service (CRS) critique of the reports in the series.[2]

A. INTRODUCTION

The statute defined explicitly what the annual Title V report should contain and the fields in which it should make recommendations to the Congress. These included:

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[1] U.S. Library of Congress. Congressional Research Service. Typed Report, by Genevieve J. Knezo, Aug. 17, 1987. Washington, 1987. 12 p.

[2] The first annual report, "Science, Technology, and American Diplomacy, 1980," was published as a joint committee print by the House Committees on Science and Technology and Foreign Affairs, as were the third annual report, "Science, Technology, and American Diplomacy, 1982," the fourth annual report, "Science, Technology, and American Diplomacy, 1983," the fifth annual report, "Science, Technology, and American Diplomacy, 1984," the sixth annual report, "Science, Technology, and American Diplomacy, 1985," and the seventh annual report, "Science, Technology, and American Diplomacy, 1986." The second annual report, "Science, Technology, and American Diplomacy," 1981, was published as a committee print by the House Committee on Foreign Affairs. CRS critiques were included in the first, third, fourth, fifth, sixth, and seventh committee prints in the series.

> (1) personnel requirements, and standards and training for service of officers and employees of the United States Government, with respect to assignments in any Federal agency which involve foreign relations and science or technology; and
>
> (2) the continuation of existing bilateral and multilateral activities and agreements primarily involving science and technology, including (A) an analysis of the foreign policy implications and the scientific and technological benefits of such activities or agreements for the United States and other parties, (B) the adequacy of the funding for and administration of such activities and agreements, and (C) plans for future evaluation of such activities and agreements on a routine basis.[3]

This analysis comments on the congruity between the statutory requirements and the report's contents. It deals with the following issues: organization of the report and the quality of its contents with regard to: funding, evaluation plans, and assessment of foreign policy and scientific and technical implications and benefits.

CRS's critique indicates that while some of the statutory requirements continue to go unmet in this report, considerable effort appears to have been made to comply with them. As a result, in general, the Department of State and the other contributing departments have compiled a comprehensive document, that will help to inform the Congress about the Nation's foreign science and technology activities and commitments and that probably will serve as a useful reference document for others outside of the Government.

B. THE ORGANIZATION OF THE REPORT

With respect to organization, the report contained many of the same useful features as the 1986 report:

- an executive summary;
- a detailed table of contents;

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[3] Sec. 503 (b) of P.L. 95-426, Oct. 7, 1978.

- a country and organization index;
- separate chapters devoted to both bilateral science and technology (S&T) activities with separate countries and also to specialized subject activities that typically are handled by specific mission agencies (including agriculture; space; energy; environment, natural resources, and population; health; oceans and polar affairs; telecommunications; transportation; defense; development; and basic science and engineering);
- separate discussions of major bilateral activities in specialized subject chapters;
- an overview of Department of State staff support functions in the Bureau of Oceans and International Scientific and Environmental Affairs; and
- three appendices, which listed cooperative S&T activities by country and by agency and which summarized U.S. Government contributions to selected international organizations that deal with science and technology.

As a new feature this year, information was contained in several sections of the report, such as in chapter 12 on transportation, about the training of foreign nationals, an issue of growing policy importance. It may be useful to seek similar information about such activities from other agencies in future reports.

Although this arrangement seems satisfactory, several weaknesses in format and content should be noted.

As in previous years there was no clear explanation given in chapter 4, which deals with bilateral science and technology activities, about why some bilateral activities were described in considerable detail and others were not. The amount of information given about bilateral activities with each country with which the United States maintains agreements differed considerably and some sections conveyed little useful data. Missing from this chapter was precise information about when or why most bilaterals were initiated and what their political aims are. However, there were considerable details regarding technical activities conducted in cooperative programs.

Also, there was confusion about exactly how many bilateral science and technology agreements the United States has underway. At one point, on page 17, it was stated that the United States "has bilateral science and technology (S&T) agreements with 86 nations around the world." Then a few lines later it was noted: "This chapter highlights activities with 25 of the countries with which the United States has active bilateral S&T programs." According to last year's Title V report, the United States maintained bilateral relations with 21 countries. Are 61 bilateral S&T agreements inactive? Who are the new partners? It is stated that Mexico and the United States have 16 bilateral S&T agreements in force, (p. 33). Does this include technical agency-to-agency agreements? Is there a difference between kinds of agreements? It would be helpful to have identified all the executive agencies that administer the bilateral program for the U.S. Government.

There are several other organizational problems. Often throughout the document when reference was made to a specific report or analysis prepared by a group or agency, insufficient information was given about the title, date, and publisher of the report, thereby making it difficult for the reader to identify the source report for further reading. It would seem appropriate that every attempt should be made to give in the text or a footnote the correct and full name of a report when it is mentioned. This problem occurred, for instance, in the executive summary discussion regarding chapter 3, in chapter 1, and in chapter 3 itself when reference was made to an unnamed Department of State report that reviewed the S and T activities of multilateral organizations. Similarly adequate bibliographic information was not given about: an unnamed report on environmental monitoring from the Bonn Economic Summit meeting and an unnamed report ". . . released by the [U.S.] Embassy [in India] in early 1986 [that] showed that over 259 projects were underway" (p. 30). Two named reports were identified (on p. 12): "The Use of Remote Sensing Technology in Africa for Drought Early Warning and Monitoring" and "A Report on the Environment" by the TG&E working group of the London Economic Summit, but no citation or source information was given.

C. FUNDING

The eighth report, like preceding annual reports, did not consistently provide information required about ". . . the adequacy of the funding for and administration of [bilateral and multilateral] activities and agreements . . . ." Financial details were given in some chapters, but generally only for a few of the activities that were described in that chapter. Among the funding information included were details regarding the Bureau of Oceans and International Environmental and Scientific Affairs (OES) funding and Department of State expenditures for participation in some bilateral agreements and international commissions and groups, (p. 10). Funding information was reported also for several agencies' international science and technology activities, including: some aspects of the Department of Agriculture's S&T cooperation (pp. 42-43); U.S. contributions to some specific International Atomic Energy Agency (IAEA) programs; some aspects of the National Park Service's funding for international park activities, (p. 88); details about the Geological Survey's international S&T cooperation, (p. 96); information about the National Oceanic and Atmospheric Administration's expenditures for international drought and disaster early warning and technical assistance;

costs of the Bureau of Mines international cooperative research activities; and U.S. expenditures for population programs. The Department of Transportation gave estimates of FY1985 expenditures for international exchange activities, consisting of "approximately $18 million for salaries and travel expenses of Headquarters and field personnel, and approximately $600,000 for participation in work of various international organizations", (p. 158). Chapter 14, on the Agency for International Development, included some detailed expenditure data as did chapter 15 on basic science and engineering activities.

Even though some financial information was included, accurate and complete information was not given for all U.S. Government science and technology efforts. Thus, it does not appear that the report meets the statutory requirements for information about ". . . the adequacy of the funding for and administration of such activities and agreements. . . ." In this respect comments made in the critique of the 1986 Title V report bear repeating:

> Apparently there are serious obstacles to reporting funding. Some agencies, for example, say that foreign and international science activities are financed from budgets for domestic programs, therefore these agencies cannot provide details about funding levels. But this method of funding should not preclude program managers from providing information about expenditure levels for foreign and international scientific and technological activities and for travel. Some agencies which use funds from domestic activity budgets do report funds expended for international activities. . . . [As stated in the critique of a previous report]
>
> > . . . The ability of Congress to conduct proper oversight of these activities without knowing levels of program expenditures is greatly impeded [because of the lack of financial information].[4]

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[4] Congressional Research Service Comments on the 1985 (sic) Title V Report, The Seventh Annual Report for 1985, Submitted to the Congress by the President Pursuant to Section 503 (b) of Title V of Public Law 95-426. In U.S. Congress. House. Committee on Foreign Affairs and the Committee on Science and Technology. Science, Technology, and American Diplomacy, 1986. 99th Cong., 2d Sess. Joint Committee Print. Washington, U.S. Govt. Print.

There is a related problem. According to the 1987 Title V report, several of the bilateral agreements discussed received congressionally authorized and appropriated line-item funding or were supported with a capital fund. This occurred in the case of the U.S.-Indian bilateral science and technology agreement, supported with a $100 million capital fund, (p. 2); the U.S.-Yugoslav Agreement, supported by a joint fund with the Yugoslav Government, with Congress appropriating $1.9 million as a line-item in the Department of State budget for FY 1987 activities, (p. 19); and the U.S.-Spain Agreement, with Congress appropriating for 1986 a total of $12 million, with $7 million transferred to the Joint Committee for Scientific and Technological Cooperation, (p. 21).

There was no clear-cut explanation in the report about why some bilateral agreements received specific authorized funding and others did not. Questions can be raised about why different kinds of funding instruments are used to support S&T agreements with different countries. How do these activities differ? Why do some have status that others do not?

D. EVALUATION

This report, like all of its predecessors, does not appear to give information which meets the statutory requirements of providing the Congress with ". . . plans for future evaluation of such activities and agreements on a routine basis." Throughout the report statements appeared which amounted to evaluations of the scientific/technical and foreign policy implications of current activities. For example:

Off., May 1986, p. 217, quoting from: Congressional Research Service Comments on the 1985 Title V Report, the Sixth Annual Report, for 1984, Submitted to the Congress by the President, Pursuant to Section 503 of Title V of P.L. 95-426.

> [With respect to Yugoslavia] the program was initiated to strengthen relations with Yugoslavia's non-aligned post-war government, and has developed into a highly visible and successful joint research and exchange program. Cooperative research projects, workshops, and the joint production and analysis of data, and the exchange of experts in most basic and applied sciences, including the agricultural, health and biomedical, environmental and earth sciences, and engineering, have proved mutually beneficial. The program is well regarded in the United States and has grown to become Yugoslavia's largest with any country (p. 23).

Such a statement appears to constitute an evaluation which used implicit and unstated criteria, thus the reader does not know the basis for the assessment. Such criteria were noticeably absent from the discussions of bilateral S&T programs in Chapter 4. It would be helpful if the next report outlined the general criteria upon which evaluations of activities are based. In addition, to comply with the statutory requirements, the report should ". . . . identify plans for future evaluation of such activities and agreements on a routine basis."

E. STATEMENTS REGARDING THE IMPLICATIONS FOR SCIENCE AND TECHNOLOGY AND FOR FOREIGN POLICY

For the most part, the report examined the scientific and technological as well as political implications of the activities described in terms which conformed to the language and intent of the statute. However, such coverage was uneven.

Many important policy issues at the interface of science, technology and foreign policy were raised. The following issues, for instance, are illustrative. There was considerable discussion about the State Department's concerns to assess the objectives of multilateral organizations that deal with science and technology. In addition, questions were raised regarding the need to "re-orient these bodies away from extraneous and polemical debate . . . ."

(p. 11.) Similarly, there was a detailed discussion of agenda and objectives for the science and technology discussion of the ministerial meeting of the Organization for Economic Cooperation and Development, (p. 13) and of the objectives of the U.N. Economic Commission for Europe, (p. 14). The report gave a candid view of obstacles to negotiations for space station cooperation, including the statement that "national pride, large investments and each partner's desire to ensure that its interests will be protected make cooperative arrangements extraordinarily complicated," (p. 45). There were details about the political and technical aspects of problems between the United States and Canada relating to air pollution and acid rain, (p.71-73). Chapter 9 on health activities set forth a well-defined and expressed set of technical and political objectives. The bulk of the chapter, especially the sections on bilateral science and technology agreements, contained considerable details about the political and technical aspects of cooperative programs. Chapter 11 on telecommunications also enunciated a clearly defined set of policy goals for international telecommunications policy, (p. 135), as did chapter 12 on transportation. Chapter 15 on basic science and engineering, which addressed the National Science Foundation programs, contained some useful policy-relevant information.

The sections on bilateral science and technology activities in chapter 4 appear lean and lacking in useful detail when compared with the bilateral activities discussed in the specialized subject chapters. This poses a dilemma since undue duplication of activity descriptions is unwarranted. Nevertheless, the question can be raised about the unevenness of the level of detail in the report and about whether some cross-referencing within the chapters might be useful.

There are also several other kinds of shortcomings, which are described next. It might be useful in the next report, when dealing with bilateral S&T activities, to convey the same level and amount of historical detail as appears in the bilateral cooperation section in chapter 7 on energy cooperation, beginning at p. 57. This chapter on energy contains comprehensive information about the foreign policy and science and technology aspects of bilateral cooperation. This level of detail and historical overview seems to represent a good standard for discussion of bilateral science and technology activities.

In chapter 4, dealing with bilateral activities, the discussion on p. 24 regarding U.S.-Soviet scientific and technological cooperation, reported that "there was a surge of activity in FY 1986 under U.S.-USSR bilaterals S&T agreements." This statement conveyed a policy direction which contrasts sharply from the past and from information in previous Title V reports which described cutbacks in U.S.-Soviet cooperative S&T activities because of political events. No explanation was given in chapter 4 about why activity levels surged. Was it due to a political realignment or changes in U.S. foreign policy posture toward the Soviet Union? There was some reference on p. 110, in the chapter on health, to a National Security Council directive which authorized the Department of Health and Human Services (DHHS) to resume high-level contacts with the Soviets and to reinvigorate cooperative activities. This directive probably was applicable to the overall S and T relationship with the Soviet Union. However, the policy change was not discussed in this report.

It seems that several other controversial policy issues were not discussed or were deliberately avoided. For instance, extensive attention was given in the 1986 report to the creation and plans of the International Committee of the Federal Coordinating Council for Science, Engineering, and Technology (CISET) and its four subgroups created within the Office of Science and Technology Policy in the White House. However, practically no reference was made to CISET and its functions in this report. Other information indicates that the Committee's work had important ramifications for many of the foreign science and technology activities conducted during 1986. It seems appropriate that the 1987 report should have discussed the outcome of major activities which were initiated in prior years, but which were continued in the succeeding year.

As another example, no clear cut attention was given to the constraints on the U.S.-Brazilian relationship in computer sciences because of Brazil's restrictions on the import of U.S. computer technology.

There are examples of discussions which presented insufficient details about activities discussed or policy issues raised, leaving the reader with unanswered questions. For instance, reference was made many times to several Presidentially initiated bilateral agreements. There was no indication about why these agreements required presidential initiatives, what a presidential initiative is, how the agreements are the same or differ from regular agreements, and so forth. This occurred, for instance, in the executive summary discussion regarding chapter 4, specifically about the Brazilian and Indian agreements. The discussion about population control programs essentially told what the program excluded, but not what its programmatic components included. For instance:

> U.S. policy emphasizes continued strong support for voluntary international family planning programs for integration of population and economic development policies, for the critical role a market-oriented economy can play in achieving population goals, and for prohibition of any U.S. support for coercion or abortion in family planning programs. Implementation of this policy resulted in no U.S. funding for the International Planned Parenthood Federation (IPPF) in 1985 and 1986 because this organization supports abortion activities through some of its affiliates in developing countries. (p. 101).

The reader sometimes was left dangling. For instance, on p. 9, it was noted that:

> The outstanding reporting by part-time officers at our Embassy in Kuala Lumpur and the Consulate General in Stuttgart demonstrates the effectiveness of the "20 percent club."

Oftentimes statements seemed misleading or only half correct. For instance, it was noted in the executive summary section regarding Japan that the United States and Japan ". . . began steps to refocus future cooperative activities to better reflect the two countries' current priorities and capacities." This statement does not disclose the intense scrutiny that was given by the White House to the U.S.-Japanese agreement, the discord which appears to have marked recent attempts to convene meetings, and the feeling among some policymakers that the S&T exchange with Japan has been unreciprocal, with the result that U.S. technology and trade have suffered. No reference to such policy discord was noted in Chapter 4 in material regarding the bilateral agreement with Japan.

F. CONCLUDING OBSERVATIONS

The eighth Title V report, like its most recent predecessors, is informative and will, undoubtedly, serve as a useful reference document even though it does not contain all of the statutorily required information. It is extremely useful to have the rich detail that was given in most sections. The better developed sections gave the reader an historical overview and a description covering the origins of an agreement, major notable scientific and technological activities, and foreign policy activities and implications. Every attempt should be made in the future to give the reader as much detail as possible to permit comprehensive understanding of an activity, rather than merely a technical or quantitative description of activities.

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